

Assault on foal pneumonia



By Denise Steffanus

The leading cause of foal pneumonia, *Rhodococcus equi*, is an insidious killer that infects foals within days of birth and silently progresses, causing abscesses in the foal's lungs that usually are not discovered until clinical signs emerge months later. Most foals that die of *R. equi* are four to six months old. The disease ranks second, behind injury, as a leading cause of death in foals less than six months old.

Researchers around the world have worked diligently for decades to improve ways to prevent, diagnose, and treat this heartbreaking disease, which also inflicts a significant economic loss on the horse industry every year.

R. equi was first identified in 1923 as *Corynebacterium equi*, an organism that grows in soil and manure. The organism is present on most farms, yet some may never experience a case of rhodococcal pneumonia, while others may battle the disease with every new foal crop.

Rhodococcal pneumonia in foals is similar to tuberculosis in humans in that small, focal points of infection begin to grow in the lungs and eventually become abscesses. During its early stage, the only evidence of the infection in a foal may be a mild fever and depression. Foals continue to nurse normally, and they even may appear bright and healthy.

Exercise may cause a slight increase in respiratory rate in these foals, which also may go unnoticed if the caretaker is not paying close attention to the foal when it is turned out. As the disease advances, the foal's

appetite may decline and its breathing may become more labored. By the time you hear a cough, the foal is in deep trouble.

“The slow spread of the lung infection combined with the remarkable ability of foals to compensate for the progressive loss of functional lung makes early clinical diagnosis difficult,” said Steeve Giguère, D.V.M., Ph.D., Marguerite Thomas Hodgson Chair of Equine Studies at the University of Georgia. Giguère led the neonatal team at the University of Florida before relocating to Georgia in 2009.

Only foals less than six months old develop *R. equi*, so it is a juvenile disease in horses. Besides seeking better ways to diagnose, treat, and prevent the disease, Giguère’s ongoing research is aimed at studying and comparing the difference in the immune responses of foals and adult horses to *R. equi* to understand what gives adult horses the ability to destroy the pathogen.

Research down under

In Australia, Gary Muscatello, D.V.M., Ph.D., concluded a study in 2008 at the University of Melbourne’s Equine Infectious Disease Laboratory that changed scientists’ perception of how foals become infected with *R. equi*.

Until Muscatello’s study, exposure to the organism in the soil was thought to be the only mode of transmission, especially when foals were exposed to aerosolized pathogens stirred up in dust.

Muscatello and his team used a hand-held air-monitoring system to measure the concentration of pathogens in the exhaled breath of foals naturally infected with *R. equi*. They then compared those levels to environmental levels of the pathogen in holding pens and lanes on endemic farms. Startling results showed that the concentration of virulent *R. equi* organisms in exhaled breath from foals was significantly higher than that in environmental air.

The team concluded: “The high concentrations of virulent *R. equi* bacteria in exhaled air suggested that aerosol transmission between foals is possible and may have a significant impact on the prevalence of *R. equi* pneumonia on farms.”

The results of Muscatello's study have added a new layer of management strategy necessary for preventing the spread of rhodococcal pneumonia among foals. It also may explain the curious results of two other studies.

Noah Cohen, V.M.D., Ph.D., and his research team at Texas A&M University surveyed 138 farms in 2003 and found that the typical farm to have a problem with *R. equi* is a Thoroughbred breeding farm with large acreage that houses 15 or more foals per season and has concrete floors in its foaling stalls—an interesting finding because *R. equi* infection had been related to contaminated soil.

In research conducted by Stephen Hines, D.V.M., Ph.D., a board-certified pathologist at Washington State University, he found density of population, rather than management practices, appeared to be the most significant factor in the spread of the disease.

If infected foals are capable of spreading the disease to one another, as Muscatello believes, this would support Cohen's and Hines' findings.

Muscatello now is carrying on his work with *R. equi* at the University of Sydney.

Ultrasound of lungs

Between 2003 and 2008, Nathan Slovis, D.V.M., head of internal medicine at Hagyard Equine Medical Institute in Lexington, began a screening program to ultrasound the lungs of foals every two weeks to check for evidence of rhodococcal pneumonia. He chose two Central Kentucky farms that previously had a significant problem with *R. equi*.

Results of the regular ultrasound examinations were graded on a scale of zero to ten, with zero being no evidence of disease. At the time of examination, Slovis noted any change in status from the previous scan, and he began a treatment regimen if the change was significant.

During the biweekly monitoring, Slovis found that a foal's immune system might resolve some lung lesions, especially smaller ones, without medical intervention. But he added, "It's impossible to predict which lesions will become clinical." So he instituted treatment for lesions grade 2 and above.

“None of the foals in the screening program got pneumonia,” Slovis said. “About 60% [of the farms’ foals] would develop pneumonia before we put them on this screening program.”

Although the screening program is costly, in the long run it is less expensive than treating foals with rhodococcal pneumonia, plus the benefits to the foals are immeasurable because the disease typically entails six to eight weeks of intensive treatment and heightened management, yet often is fatal despite the measures taken.

Some foals put on a treatment regimen might clear the disease naturally if they were not treated. So owners may consider treatment costs for every foal that develops a grade 2 lesion as a waste of money. But not treating at the early stage of *R. equi* is risking the foal’s life.

No magic metal

Hopes for a novel way to prevent *R. equi* using the metal gallium maltolate were dashed in 2009 when Texas A&M’s field trial did not return the results expected.

In 2006, researcher Ronald Martens, D.V.M., enthusiastically reported that he had good results in killing *R. equi* in test-tube studies and in laboratory mice using gallium, and he said he was eager to try it in foals.

“Gallium works by starving the bacteria,” Martens explained in 2006. “It does that because bacteria, as all living things, need iron to live. Gallium is very similar in some respects to iron. So the bacteria think it is iron and takes it in, but it can’t utilize it. The gallium starts to interfere with the bacteria’s DNA production. When they can’t reproduce, they eventually die.”

In a field study performed at 12 breeding farms with a history of endemic *R. equi* infections, 483 foals were divided into two groups, with one group treated with gallium maltolate and the other with a placebo for the first two weeks of life. No significant difference resulted between the groups.

The researchers concluded that gallium maltolate did not effectively reduce the incidence of mortality of rhodococcal pneumonia among foals on endemic breeding farms.

Challenges to prevention

Because a foal becomes infected shortly after birth, the logical route to provide immunity would be through passive transfer from the mare in her colostrum, the antibody-rich first milk. A secondary approach would be to drench the foal with hyperimmune colostrum containing antibodies to *R. equi* shortly after it is born.

“Unfortunately, neither vaccination of the dam before parturition nor administration of hyperimmune colostrum to foals has proven to be effective,” reported Cohen. “However, evaluation of these approaches has been somewhat limited.”

The only alternative to these two approaches is to have a veterinarian administer a transfusion of hyperimmune plasma to all newborn foals on endemic farms to reduce the incidence and severity of rhodococcal pneumonia.

Overall, researchers into this disease emphasize that a single approach to controlling and preventing *R. equi* will yield disappointing results. Changes in management practices to reduce the herd density, vigilant removal of manure from pastures where foals are kept, closer monitoring of foals visually and by ultrasound screening, and administration of immunostimulants to newborn foals must be included in an overall program to reduce the incidence of rhodococcal pneumonia.

Researchers around the world continue to work to understand this challenging disease so they can develop a vaccine or other means to prevent foals from becoming infected.

In the meantime, specialized treatment of foals with rhodococcal pneumonia at neonatal referral centers is saving more of these babies. In the early 1980s, the survival rate for foals with *R. equi* was a mere 20%. Now, skilled neonatal units are achieving survival rates between 59% and 72%.

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