Rhodococcus equi Foal Pneumonia: Failure of Serologic Tests to Accurately Detect Disease

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Serologic assays, whether conducted on single samples or multiple samples to assess seroconversion, do not provide reliable information on which to formulate, substantiate, or eliminate a diagnosis of Rhodococcus equi foal pneumonia. Authors' addresses: College of Veterinary Medicine, Texas A&M University, College Station, TX 77843 (Martens, Cohen, Chaffin); Kitasato University, Towada, Aomori 034, Japan (Takai); Veterinary Dynamics, Inc., Templeton, CA 93465 (Doherty); Texas Veterinary Medical Diagnostic Laboratory, College Station, TX 77843 (Angulo); and Heart of Texas Equine Clinic, Waco, TX 76705 (Edwards). © 2002 AAEP.

1. Introduction

Rhodococcus equi, a causative agent of severe pneumonia in foals, normally resides in soil, and inhalation of bacteria-laden dust is thought to be the most common route of exposure and infection.1 Recent evidence indicates that most foals that develop R. equi pneumonia become infected during the first few days after birth.2 The onset of clinical signs of disease, however, is most common in foals that are 30–60 days old, but the disease may not be apparent for several months.1,2

Only R. equi that possess an 85- to 90-kb virulence-associated plasmid and produce the 15- to 17-kDa virulence-associated protein antigen (VapA) are considered capable of causing disease in foals.3 Evidence indicates that soil from farms that do not have a history of R. equi disease are just as likely to contain virulent or avirulent R. equi as farms that have a recent history of disease.3,4 Farms on which the disease is endemic, however, have greater concentrations of virulent R. equi in the soil.3 Based on the world-wide distribution of this organism and serologic evidence that most horses develop R. equi–specific antibodies, it is apparent that most horses are exposed to virulent or avirulent strains.1,3

Specific diagnosis of R. equi pneumonia in foals, particularly before the onset of clinical signs, is often problematic. A variety of R. equi serologic assays have been developed, primarily as research tools. The use of serologic tests to diagnose R. equi infections has been proposed; however, studies on the sensitivity (proportion of disease-positive foals that are test-positive) and specificity (proportion of disease-negative foals that are test-negative) of these tests have not been conducted.1 In their efforts to more effectively manage foals with respiratory tract diseases, numerous veterinarians in private practice rely on serologic assays
to establish, confirm, or exclude diagnoses of *R. equi* pneumonia.

This study was designed to determine the sensitivity and specificity of five serologic tests to diagnose *R. equi* foal pneumonia before the onset of clinical signs, on the basis of single assays at various ages or differential values between paired samples (seroconversion), and to differentiate foals infected with *R. equi* (affected) from unaffected foals at the time of clinical diagnosis.

2. Materials and Methods

This was a nested case-control study that involved 26 foals on a farm endemic for *R. equi*. Serum samples were collected from all foals on the farm when they were 2, 4, and 6–7 wk old and at the time of clinical diagnosis for those that developed *R. equi* pneumonia; samples also were obtained from age-matched controls. Samples from affected and unaffected foals were segregated, and when possible, one age-matched unaffected foal was compared with each affected foal. Sera were tested by use of enzyme-linked immunosorbent assays (ELISA-6939, ELISA-33701, and ELISA-VapA), agar gel immunodiffusion (AGID), and synergistic hemolysis inhibition (SHI) tests.

The sensitivity and specificity were reported for each serologic assay. Continuous or ordinal data (e.g., serologic titer) were compared between groups. Categorical data (e.g., proportion of seroconvertors) also were compared. Changes over time between affected and unaffected foals were evaluated.

3. Results

Analysis of values for sensitivity and specificity indicated that none of the tests significantly differentiated affected from unaffected foals at any testing period. There was no significant difference in the proportion of affected and unaffected foals that had increased test values in paired samples (seroconversion). All test values increased significantly over time; however, there was no significant difference in rates of increase between affected and unaffected foals.

4. Discussion

This investigation evaluated the sensitivity and specificity of five *R. equi* serologic assays for serum samples obtained from *R. equi* disease-positive (affected) and unaffected foals at various ages from a farm in Texas on which *R. equi* pneumonia was endemic. There was a significant increase in values for all tests over time; however, none of the tests significantly differentiated affected from unaffected foals at any of the testing periods. Results of this study indicate that these serologic assays do not reliably detect early stages of disease or identify affected foals by the time a specific diagnosis can be achieved by standard diagnostic methods. On the basis of increased test values for all assays in each foal over time, it seems that serologic analyses reflect exposure to *R. equi*. Because there are greater concentrations of virulent *R. equi* in soil of farms that are endemic for *R. equi* pneumonia, foals from endemic farms might be expected to have greater serologic test values regardless of disease status.

The use of serologic tests to effectively diagnose diseased foals or to screen foals and accurately identify those that are most likely to be infected is very appealing to clinicians. At least three of the serologic assays investigated in this study are commercially available in the United States, and numerous veterinarians have relied on them to establish, confirm, or exclude diagnoses of *R. equi* pneumonia.

Based on this investigation, the authors do not believe that serologic assays, whether evaluated on a single sample or multiple samples to assess seroconversion, are reliable for the diagnosis of *R. equi* pneumonia. In addition, because of the high probability of false-positive and false-negative results, it seems that serologic assessment of *R. equi*–specific antibodies is not an effective screening tool for the identification of foals that are most likely infected with *R. equi*.

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References