

Estimation of sensitivity and specificity of a novel clinical scoring system for on-farm diagnosis of bovine respiratory disease in pre-weaned dairy calves

W.J. Love, DVM, MPVM¹; **T.W. Lehenbauer**, DVM, MPVM, PhD, DACVPM-Epi^{1,2};
A.L. Van Eenennaam, PhD³; **C.M. Drake**, PhD⁴; **P.H. Kass**, DVM, MVP, MS, PhD, DACVPM-Epi²;
T.B. Farver, PhD²; **S.S. Aly**, BVSc, MPVM, PhD^{1,2}

¹*Veterinary Medicine Teaching and Research Center, School of Veterinary Medicine, University of California, Davis, Tulare, CA 93274*

²*Department of Population Health and Reproduction, School of Veterinary Medicine, University of California, Davis, CA 95616*

³*Department of Animal Science, University of California, Davis, CA 95616*

⁴*Department of Statistics, University of California, Davis, CA 95616*

Introduction

Bovine respiratory disease (BRD) is an important economic disease of cattle in modern production systems. Control of BRD in calves is especially important because calfhood infections lead to reduced weight gain and productivity. Accurate detection of animals affected with BRD remains a significant hurdle for control and treatment. Several clinical scoring systems for BRD diagnosis have been proposed. One scoring system proposed by researchers at the University of Wisconsin–Madison (WI system, McGuirk, 2008) uses 5 clinical signs, each partitioned into 4 levels of severity. A second system (BRD3 system, Love et al, 2014) was developed at the University of California, Davis, to create a system that required less qualitative categorization of clinical signs and reduced calf handling. The BRD3 system used 6 clinical signs each classified as normal or abnormal. The goal of this study was to estimate and compare the diagnostic accuracy of these 2 clinical scoring systems.

Materials and Methods

The WI and the BRD3 scoring system were compared using a nested case-control study. Hutch-raised calves from 5 calf-raising premises in Kings and Tulare counties in California were sampled between April and September, 2013. Calves were scored using both systems and evaluated for pneumonia using auscultation and thoracic ultrasound (TUS). The results of auscultation and TUS were interpreted in parallel and used as a reference test to estimate the sensitivities and specificities of each of the systems. The sensitivities and specificities of the 2 systems were compared using McNemar's test.

Results

A total of 543 calves were sampled. Calf ages ranged from 15 to 137 days (mean 56.2 days). The

sample included 383 heifer calves and 159 bull calves (sex was missing for 1 calf). The sample included 365 Holstein, 174 Jersey, and 4 mixed breed calves. Pneumonia was detected in 223 (41.1%) of the study calves. Fifty-one calves had only abnormal auscultation, 57 had only abnormal TUS, and 115 calves had abnormal auscultation and TUS. Of the 543 enrolled calves, 159 calves were positive by the BRD3 scoring system and 147 calves were positive by the WI scoring system. The BRD3 scoring system's sensitivity to detect pneumonia in calves was 57.0%, and its specificity to classify calves without pneumonia was 89.9%. The WI scoring system sensitivity to detect pneumonia in calves was 56.3%, and its specificity to classify calves without pneumonia was 93.1%. The sensitivity of the 2 systems was not found to be significantly different ($p = 0.77$), but the specificity of the 2 tests was significantly different ($p = 0.041$). The sensitivity of the WI score was consistent with that from a previous study by Buczinski et al (2014), which estimated 55.4% sensitivity. However, the WI system specificity was higher in this study (93.1%) than in the Buczinski study (58.0%). Such a difference may be attributed to the difference in case definitions between the 2 studies; specifically, only TUS was used to define BRD in the Buczinski study versus both TUS and auscultation were used in parallel in the current study.

Significance

The current study is the second to estimate the diagnostic accuracy of the WI system and the first to estimate the accuracy of the BRD3 system. The comparable sensitivity, simpler design and reduced calf handling required by the BRD3 system may make it the preferred system for field use.