The value of using enhanced case definitions for the management of BRD in commercial feedlots

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Abstract

Bovine respiratory disease (BRD) is the primary cause of morbidity and mortality in cattle during the feeding period. Management of BRD cases relies on the observation of cattle behavioral changes by caregivers. This paper describes the use of multiple antemortem diagnostic technologies in combination to improve outcomes in the clinical management of BRD.

Key words: bovine, cattle, BRD, diagnosis, Whisper®

Résumé

Complexe respiratoire bovin (CRB) est la principale cause de morbidité et de mortalité chez les bovins au cours de la période d'alimentation. Gestion de cas BRD est basée sur l'observation de bovins les changements de comportement par les aidants naturels. Ce document décrit l'utilisation de multiples technologies de diagnostic ante-mortem en combinaison pour améliorer les résultats dans la gestion clinique de BRD.

Background

Bovine respiratory disease (BRD) is the primary cause of morbidity and mortality in cattle during the feeding period.[2,6,9] Consequently, BRD is associated with substantial economic losses stemming from treatment costs, reduced performance, and death loss.[3,4,5,11] While BRD has remained an important health and economic concern for decades, challenges persist in improving case definition for the treatment of BRD. The growing industry-wide demand for reduction of antimicrobial use is driving the need for better case definition through which selective or targeted treatments can be administered.

Challenges with Current Case Definitions for BRD

In feedlots, BRD diagnosis has historically been based on visual observation and rectal temperature, but many times these tools fail to accurately detect BRD. Lung lesions are often found at the time of slaughter in cattle that were never treated for BRD.[12,13] Visual observation is highly subjective from caregiver to caregiver. Furthermore, because cattle are prey creatures, sick animals often hide clinical signs in an effort to conceal weakness from potential predators. Therefore, it can be difficult for pen riders to identify affected animals early enough in the disease progression for maximal treatment efficacy. Depression and loss of appetite may also be associated with health problems other than respiratory disease, such as lameness, dehydration, and digestive disorders. Observation of the respiration rate can provide insight into the nature of the respiratory problem, but is not conclusive. While rectal temperature (RT) is correlated with BRD case fatality, this correlation is weak.[8] Rectal temperatures can vary from animal to animal and with environmental factors over time, and it is difficult to account for such variation when assigning case definition.[7] In practice, an arbitrary cut-off is used to classify animals as febrile, such as 104°F (40°C). Due to the subjective nature of visual evaluation and the imperfect correlation between fever and case fatality, case definitions are not well-defined and treatment outcomes are difficult to measure and compare.

Use of Enhanced Case Definitions for the Treatment of BRD

After being identified as sick and pulled from the home pen, cattle are typically moved to a treatment area, where a case definition (CD) for BRD presence, severity, and chronicity is assigned by a trained caregiver, based on RT, attitude and appearance. Sometimes manual thoracic auscultation is used to refine CD. The implementation of evidence-based therapies, however, is ineffective as this process, with or without manual auscultation, is highly variable within and between caregivers. We applied a computer-based algorithm[a] to sounds recorded during the initial assessment for suspected BRD of 17,848 cattle from 13 sites to determine if algorithm-based analysis of lung auscultation would improve BRD CD precision. Briefly, we placed the microphone on the right side of the thorax per manufacturer's instructions to capture 8 seconds of sounds that were processed with the software. A discrete score (LS) of 1 to 5 was applied to each calf (1 = normal, 5 = chronic or severe BRD) for use in the treatment decision protocol. Rectal temperature was also a factor in the treatment protocol. Outcomes were measured by case fatalities (CF) – individuals that died of respiratory

disease following treatment protocol. We expected a high LS to be associated with a greater chance of CF. A logistic regression model using body weight (BW), RT and LS was constructed to estimate the likelihood of CF. For each 1 unit rise in LS, the likelihood of CF increased by 49.4% adjusted for RT and BW (odds ratio (OR) = 1.494, 95% CI 1.428-1.564). For each 1 degree F increase in RT, the likelihood of CF increased by 19.1% (OR = 1.191, 95% CI 1.149-1.234). There was a statistically significant but clinically insignificant impact of BW on CF. These data suggest that algorithm-based analysis of lung auscultation is an effective tool in practical applications to predict individual clinical outcomes. Standard case definitions for BRD based on lung auscultation and RT can improve evaluation of treatment success and can be used in the development of evidence-based treatments for BRD.

Using Multiple Diagnostic Modalities to Define BRD Status at Placement

Because BRD is commonly diagnosed in the first 21 days post entry to the feedlot, prophylactic antibiotic therapy (PA) is commonly applied at the time of arrival to those cattle perceived to have a high risk of developing BRD. The ability to predict if a pen-lot will have a high rate of BRD post-arrival is imprecise at best, making evidence-based application of prophylactic antibiotics nearly impossible. Objective tools to assess the health of the respiratory tract at the time of feedlot arrival would allow for the application of PA in only pen-lots of cattle with a significantly increased risk of developing BRD. We applied a computer-based algorithm[a] to sounds from thoracic auscultation recorded during post-arrival processing of 25 pen-lots containing 2069 cattle (X = 3/pen, 95% CI 64-101) in 1 feed yard to determine if algorithm-based analysis of lung auscultation at arrival would facilitate the identification of pen-lots with higher BRD morbidity over the first 30 days post placement. Again, we placed the microphone on the right side of the thorax per manufacturer's instructions to capture 8 seconds of sound that were processed with the software. A discrete score (LS) of 1 (normal) to 5 (chronic or severe) was assigned to each calf. Rectal temperature and BW were also captured. Outcomes were measured as BRD morbidity in the first 30 days post placement. Cattle with a LS 3 or higher or with RT of at least 104.5°F (40.3°C) were treated with antibiotics. Stepwise linear regression was used to determine the value of algorithm-based auscultation at arrival as a predictor of pen-lot BRD morbidity rate. The final model was [% morbidity = 0.65 x % LS 3 at arrival] (R^2=0.62, P<0.001), meaning that a 1% increase in LS 3 prevalence at placement was associated with a 0.65% increase in morbidity even with treatment of diagnostically abnormal cattle at arrival. These data suggest that algorithm-based analysis of thoracic auscultation can be used not only to better predict individual treatment outcomes, but also to predict pens at risk of high BRD morbidity. Further research is needed to adapt PA protocols in an evidence-based manner.

Future Directions

While using computer-based algorithms to assess lung sounds is more accurate than physical exam and temperature assessments alone, they do not explain all of the variation in case fatality rates for cases of BRD. Numerous other technologies have been demonstrated to be moderately predictive of outcome in cases of BRD, including serum lactate analysis[1] and thoracic ultrasound[9]. It is likely that combining multiple technologies into a single systematic diagnostic process will yield the best results for predicting the severity and chronicity of BRD in feedlot cattle. This increased precision will allow for the development of more robust evidence-based treatment platforms which will be key in improving both clinical outcomes and improving the judicious use of antibiotics.

Endnotes

[a]Whisper®, Geissler Corp. LLC, Minneapolis MN

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