

Pre-weaning bovine respiratory disease in the cow-calf herd

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Abstract

Bovine respiratory disease (BRD) in beef calves prior to weaning is a problem for 1 in 5 cow-calf farms. Pre-weaning BRD is a costly problem for the cattle industry and a detriment to animal well-being. This is a perplexing health problem because ranch calves typically live in conditions of little stress and relative isolation, risk factors commonly associated with BRD in weaned calves. Some factors that appear to be related to BRD risk in pre-weaned calves are waning maternal immunity, loss of herd immunity in herds with short calving periods, activities that result in increased animal density, calf gender, and age of the dam. Collectively, these factors are related to the calf's ability to resist infection and to opportunities for pathogen exposure. Activities such as commingling and weaning may have less impact on calf health if they are completed prior to or after calves are 3 to 5 months of age, thereby avoiding the period of greatest susceptibility. Vaccination programs intended to induce adequate immunity in calves prior to 90 days of age have shown some efficacy, but require further study.

Key words: cattle, beef, cow-calf, BRD

Résumé

Le complexe respiratoire bovin (CRB) chez les veaux de boucherie avant sevrage est un problème dans près de 20% des exploitations vaches-veaux. Le CRB en pré-sevrage coûte cher à l'industrie du bœuf et nuit au bien-être des animaux. Ce problème de santé laisse perplexe car les veaux dans les ranchs sont quand même assez isolés et soumis à peu de stress, deux facteurs de risque associés au CRB chez les veaux sevrés. Les facteurs suivants semblent être reliés au risque de problèmes respiratoires chez les veaux pré-sevrés : l'immunité maternelle décroissante, la perte de l'immunité de troupeau dans les troupeaux avec courtes périodes de vêlage, les activités qui augmentent la densité animale, le genre du veau et l'âge de la mère. Ensemble, ces facteurs influencent la résistance à l'infection du veau et les chances d'exposition aux agents pathogènes. L'agrégation des veaux et le sevrage peuvent avoir moins d'impact sur la santé du veau s'ils sont complétés lorsque les veaux ont moins de 3 à 5 mois d'âge, ce qui permet d'éviter la période de plus grande susceptibilité. Les programmes de vaccination dont le but est de rehausser

l'immunité chez les veaux âgés de moins de 90 jours se sont avérés assez efficaces mais nécessitent plus de travaux.

Introduction

In some cow-calf herds pneumonia (bovine respiratory disease or BRD) is a leading cause of sickness and death of calves, especially after the first few weeks of life.¹³ This is perplexing because ranch calves typically live in conditions of little stress and relative isolation. Surveys of beef cattle producers¹⁵ and veterinarians¹⁶ from the northern plains region and southeastern US indicate that pre-weaning BRD is a problem for approximately 1 out of 5 cattle producers. Pre-weaning BRD may affect up to 10% of US beef calves,⁴ resulting in death of 0.6% to 1.4% of all calves.^{2,11,12} Calves affected with pre-weaning BRD may weigh 17 to 37 lb (7.7 to 16.8 kg) less at weaning, compared to calves not affected.^{11,14}

The Cost of Pre-Weaning BRD

A risk analysis of the cost of pre-weaning BRD is currently underway,^a but "back of the envelope" calculations considering death loss, morbidity, and treatment costs indicate that BRD in pre-weaned calves might currently cost the US cattle industry \$290 million annually.^a If so, that is approximately \$10 for every beef cow in the country, or \$50/cow in affected herds.

Epidemiology of Pre-Weaning BRD

As with all infectious diseases, the occurrence of BRD is affected by factors of host immunity, presence of specific pathogens, and opportunity for transmission of pathogens between or within herds. It may be useful to think of the various factors that contribute to risk for respiratory disease as component causes. Each factor that contributes to the development of disease is a "component cause". Disease is observed when component causes add up to complete a sufficient cause.⁹ Without completing a sufficient cause, there is no expression of disease. Component causes explain why we might recover *Mannheimia haemolytica* from a deep nasopharyngeal swab of a calf without respiratory disease (other component causes being absent), or why a rancher might observe greater rates of BRD with changes in the weather, and another rancher observes BRD following

a pasture move (different component causes completing the sufficient cause). Each outbreak of respiratory disease is the result of the completion of a sufficient cause, which might have also included components of viral and bacterial pathogens, a certain state of immunity, or other component causes of respiratory disease in cattle that we fail to understand. Removing 1 or more component cause prevents the expression of disease. Manageable component causes are called “key determinants”.

Agents

Although the bacterial pathogens of pneumonia are commonly found in the upper respiratory tract of cattle, the inciting damage is often due to viral infections that may not be present in all cattle herds all of the time. Commonly recognized viral BRD pathogens are bovine herpes virus 1, bovine viral diarrhoea virus, and bovine respiratory syncytial virus, but many others, including bovine coronavirus,^{5,6} are likely to be involved.

Pathogen Transmission

In confinement systems, the opportunity for pathogen transmission is high because of animal density. But, even in extensive pasture-based systems typical of cow-calf production, opportunities for pathogen transmission may be high because cattle congregate closely around water sources, feedbunks, in shade, and when bothered by flies. Some management practices, such as pasture moves and gathering for sorting, result in high animal density and greater opportunity for pathogen transmission.

Age-Associated Immunity

Passively acquired maternal immunity is important for protecting calves against respiratory pathogens. However, maternal antibodies wane with time. Approximately every 16 to 20 days after ingestion, the amount of maternal antibodies left in the blood stream is halved, so that by 96 to 120 days of age, a calf retains less than 2% of the antibodies it absorbed from colostrum. The immune system is functional but unprimed at birth, and prior to 5 to 8 months of age the immune response of calves is weak, slow, and easy to overcome.¹ Therefore, even in the absence of additional stressors, calves 3 to 5 months of age may be particularly susceptible to pneumonia.

Herd Immunity

Herd immunity is the protection afforded to susceptible individuals because the majority of the individuals in the population are immune. In herds with a narrow calving window, calves are similar in age and herd immunity is lost in a short span of time as calves approach 90 to 120 days

of age. Vaccines to improve immunity against respiratory pathogens have been important for reducing the incidence of BRD in feedlot calves. However, the optimum vaccination protocol to prevent BRD in calves < 5 months of age remains an important subject of investigation. Weaning, commingling groups, and exposure to severe weather can be powerful stressors that further reduce a calf’s ability to resist disease.

Other Factors Affecting Risk for Pre-Weaning BRD

Health records representing over 5,000 calves from 20 cattle-management groups within 4 beef cattle ranches were analyzed to test the effect of calf gender and age of the dam.^b We concluded that the sex of calves affects their risk for BRD (bulls > steers > heifers), and calves born to dams younger than 4 years of age had greater risk for BRD. The male sex of other species has been associated with greater risk for pneumonia.^{3,17} The age of the dam may be a correlate of colostrum absorption. Colostrum ingestion may be delayed for calves born to a young dam because of dystocia or poor mothering skills. Also, the young dam’s colostrum may not contain as many antibodies, in quantity and range of protection, as older dams.^{7,8,10}

Prevention of Pre-Weaning BRD

Management and environment-related risk factors for pre-weaning BRD have been the subject of research.^{2,4,15,16} Management practices prior to weaning, such as gathering and sorting for artificial insemination, provide opportunity for pathogen introduction and transmission. Activities such as gathering, commingling, sorting, and weaning that increase stress and opportunities for pathogen transmission may have less impact on health if they are completed prior to or after calves are 3 to 5 months of age.^b Anecdotal evidence indicates that vaccination programs intended to induce adequate acquired immunity in calves prior to 90 days of age have shown some efficacy, but require further study.

Endnotes

^aSmith DR et al, unpublished

^bSmith DR et al, unpublished

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