Strategies to reduce bovine respiratory disease (BRD) in southeastern beef calves

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Introduction

The bovine respiratory disease (BRD) complex is the most important cause of morbidity and mortality in calves from U.S. beef and dairy herds.[1] Economic losses associated with clinical disease are more significant in beef calves around the time of weaning, young dairy calves under 3 months of age, and pre-weaning beef calves. The impact of factors such as failure in the transfer of passive immunity, decay of maternal antibodies, transport, commingling, biosecurity breaches, etc. in individual herds introduces variation in the clinical presentation of BRD in each calf group. The majority of weaned beef calves from southeastern US cow-calf production systems are marketed through auction barns and commingled with other cattle multiple times before reaching their next stage in production.[2,3] This results in multiple opportunities for single or simultaneous exposure to respiratory pathogens. Respiratory viruses such as bovine herpesvirus 1 (BHV-1), bovine viral diarrhea virus 1 and 2 (BVDV 1, BVDV 2), bovine respiratory syncytial virus (BRSV), bovine parainfluenza virus 3 (BPIV3), bovine coronavirus (BoCV), and Influenza D virus (IDV) play an important role in the pathogenesis of BRD and promote secondary bacterial infections.[4,5] Although whole-herd vaccination against BRD

pathogens is a common practice among producers and veterinarians to minimize calf losses associated with morbidity, some studies have reported inconsistent efficacy of commercially available BRD vaccines to reduce morbidity and mortality in calves.[6] Methaphylactic treatment with antimicrobials at the time of arrival of calves to stocker or feedlot operations is highly effective reducing BRD-associated calf morbidity and mortality; however, the diagnosis of subclinical BRD in cattle is challenging and identifying the calves that actually need antimicrobial treatment at arrival has been a controversial subject. This phenomenon has resulted in the overuse of antimicrobials under the metaphylactic label and therefore in an increased incidence of isolation of multidrug resistant bacteria from the lungs of cattle dying from BRD in feedlot farms. Alternative management strategies such as different weaning methodologies that minimize stress and boost calf performance could benefit southeastern cow-calf producers by increasing weaning weights and benefit stocker/feedlot producers through reduction of losses associated with BRD.

Key words: BRD, vaccination, antimicrobial, metaphylaxis, weaning, fence-line

1. MODIFIED-LIVE VIRUS VS. INACTIVATED VIRUS VACCINES

1a. Efficacy of MLV and KV vaccines reducing BRD in weaned beef calves

The most important goal of vaccination of beef calves around the time of conventional weaning (5-8 months of age) is to reduce clinical presentation of BRD after shipment and arrival to stocker/feedlot operations. Studies evaluating MLV and KV vaccines on the reduction of clinical disease caused by naturally occurring BRD after weaning were subjectively assessed. Modified-live and KV vaccines used in these studies contained at least one of the following pathogens, BHV-1, BVDV 1, BVDV 2, BRSV, BPI3V, *Mannheimia haemolytica*, *Pasterella multocida*, and

Histophilus somni. In all studies, vaccination of calves occurred in the transition from weaning to arrival to the feedlot. In general, reduction of BRD morbidity and mortality was reported in 75% and 67%, respectively, of the studies using MLV vaccines;[7-15] however, reduction of BRD morbidity and mortality was reported only in one study using KV vaccines. Vaccination protocols including BVDV 2, *Mannheimia haemolytica, Pasterella multocida* and early vaccination (before weaning, before arrival) resulted in a greater reduction of clinical BRD. Studies evaluating the use of MLV and KV vaccines on the reduction of clinical disease caused by experimental challenge of calves with respiratory pathogens were also assessed. Vaccination of calves occurred between 5-12 months of age and experimental challenge with one of the following agents, BVDV, BHV-1, BRSV, *M. haemolytica*, or *Mycoplasma bovis* occurred between 3-230 days after vaccination. Reduction of BRD morbidity and mortality among studies using MLV or KV vaccines or comparing MLV vs. KV vaccines was similar and varied between 80-100% for both, morbidity and mortality.[16-20] One study reported no effect of vaccination of recently weaned beef calves with a *M. bovis* vaccine on clinical disease, mortality, or pathologic lesions after experimental challenge.[21]

1b. Efficacy of MLV and KV vaccines reducing BRD in young dairy calves

Respiratory disease is the number one cause of morbidity and mortality of young dairy calves in U.S. dairy herds. Studies evaluating the effect of multivalent MLV vaccines on the reduction of natural occurrence of BRD in dairy calves between 1-3 months of age have not demonstrated significant reduction of morbidity and mortality.[22,23] One study reported that dairy calves with greater levels of colostrum derived serum antibody titers against BHV-1 and BRSV had lower odds of developing BRD signs compared with calves with lower titers.[24]

Studies evaluating reduction of BRD in vaccinated dairy calves following experimental challenge with respiratory viruses reported >80% reduction of BRD morbidity and >50% reduction of BRD mortality for MLV vaccines. Reduction of BRD morbidity was 33% for studies using KV vaccines.[25-29] Vaccination and experimental challenge of young dairy calves with a homologous BVDV strain resulted in protection up to 7 months after vaccination in one study;[30] in contrast, vaccination and experimental challenge with a heterologous BVDV strain 4.5 months after vaccination resulted in severe clinical disease in another study.[31]

1c. Efficacy of MLV and KV vaccines reducing BRD in pre-weaned beef calves

Different from U.S. diaries, the prevalence of BRD in pre-weaned beef calves is variable among U.S. cow-calf herds. There are few studies evaluating the effect of vaccination of young beef calves on the reduction of natural occurrence of BRD before weaning. Two studies evaluating the use of MLV or KV demonstrated no effect of vaccination on reduction of naturally occurring pre-weaning BRD morbidity and mortality.[32,33]

Studies evaluating the effect of vaccination of young beef calves with MLV or KV vaccines on the reduction of BRD following experimental challenge with respiratory viruses such as BVDV, BRSV, and BHV-1 have produced inconsistent results with the majority demonstrating no effect of vaccination.[34,35] Colostrum-derived antibodies provided clinical protection to unvaccinated control calves in these studies. The presence of greater levels of specific BVDV 1a and BVDV 2a antibodies in vaccinated calves before experimental challenge with BVDV resulted in reduction of viremia and BVDV shedding but did not improve clinical protection compared with unvaccinated calves with moderate to low colostral antibodies.[34] In a recent report, beef calves that nursed colostrum from vaccinated dams demonstrated lower rectal temperatures and reduced BRSV shedding after experimental challenge with BRSV at 3.5 months of age.[36]

2. METAPHYLAXIS

Despite the tremendous research efforts in the last 30 years to develop effective vaccination protocols for beef and dairy calves, the incidence of BRD-associated morbidity and mortality in this population of animals has not changed and some investigators believe it has rather increased.[37,38] In contrast, antimicrobial treatment of cattle with subclinical BRD at arrival to stocker and/or feedlot operations has consistently resulted in a reduction of BRD morbidity and mortality during the start of the feeding period.[7,39,40] The accurate diagnosis of subclinical BRD in dairy calves or beef calves arriving to stocker operations or feedlots is critical for effective antimicrobial treatment and to promote antimicrobial stewardship within bovine veterinary practitioners and producers; however, the diagnosis of subclinical BRD is very challenging and based on subjective (non-confirmatory) clinical scores.[41] Additionally, in the majority of cases the diagnosis and decision-making involving metaphylactic treatment of calves with suspect BRD is made by non-veterinary professionals. This has led to an increased use of mass treatment of calves considered at high risk of developing BRD with antibiotics during the arrival processing at stocker or feedlot operations. In the author's opinion, these factors are leading to antibiotic overuse and recently reports of multidrug resistance Mannheimia haemolytica and Pasteurella multocida in beef calves that received antibiotic treatment at arrival to stocker and feedlot operations are increasing.[42,43] The administration of antimicrobials to calves with subclinical BRD could effectively reduce losses associated with calf morbidity and mortality if used consciously and based on accurate diagnosis. Recently, the use of bilateral thoracic ultrasound examination in addition to a clinical score has provided some light on improving the diagnosis of subclinical BRD and therefore the decision making process for antibiotic treatment.[41,44] The use of metaphylactic antimicrobial treatment of calves without an accurate diagnostic

approach for the prevention of BRD morbidity and mortality is unsustainable due to the increased risk of developing multidrug resistant BRD-associated bacteria; however, if selectively used based on an accurate diagnosis, metaphylaxis can be a sustainable and effective alternative to reduce losses associated with BRD.

3. WEANING METHODOLOGIES

Beef calves in the United States are commonly weaned from their dams around 7 months of age. This separation from their dam usually occurs abruptly, which can cause extreme stress in the calf. Physiological responses to weaning including increases in concentrations of plasma cortisol, norepinephrine and synthesis of acute phase proteins that induce a pro-inflammatory state and increase the risk of disease such as BRD.[45] The behavioral and physiological responses associated with weaning reduce performance in calves and impair health. Weaning stress can be compounded by transportation, dietary changes, commingling/social challenges and environmental changes.

Alternative weaning methods reduce calf stress and help with the transition to the next stages of production. Results from some studies have demonstrated that calves weaned and allowed to have fenceline contact with their dams spend more time eating than calves that are weaned abruptly.[46,47] Other beneficial effect of fence-line weaning include decrease in calf weight-loss and improved performance at the feedlot compared to traditional weaning methods. In another study, calves weaned with nose-flaps for 14 days and then separated from their dams spent 79% less time walking and 96% less time vocalizing compared to abruptly weaned calves.[48] Another study demonstrated a clear performance advantage of fence-line weaned beef calves compared with nose flap and abruptly weaned calves.[47] Despite the potential performance and health

benefits of improved weaning methodologies, the adoption rate of these practices among southeastern producers is relatively low. The implementation of these practices has demonstrated extended beneficial effects on calf performance in all stages of production from the cow-calf farm, to the stocker/backgrounder to the feedlot.

CONCLUSION

A strategic combination of weaning management practices, strategic vaccination protocols that match the highest immune response at the time of highest risk of exposure, and an accurate-BRD-diagnosis based metaphylactic treatment program for calves with subclinical BRD should be the focus of BRD prevention in cattle.

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