Introduction

Bovine Respiratory Disease (BRD) is a multi-factorial disease, usually resulting from the interaction of bacterial and viral agents, combined with stress factors [1] such as weaning, transportation, pooling of cattle from multiple sources, dusty conditions, parasitism, concurrent diseases and weather extremes and environmental factors ultimately resulting in bronchopneumonia [2,3]. The viral pathogens associated with BRD include bovine herpesvirus type 1 (BHV-1), parainfluenza-3virus (PI3), bovine viral diarrhoea virus (BVDV), and bovine respiratory syncytial virus (BRSV). In addition, bacterial pathogens associated with BRD are Mannheimiahaemolytica, Mycoplasma bovis, Pasteurellamultocida and Histophilusomnini [3].

BRD continues to be one of the most common animal health concerns in commercial feedlot production, and can result in significant economic losses [4]. BRD is causing approximately 75% of the morbidity and over 50% of the mortality in feedlots [5]. It is estimated that BRD is responsible for the loss of more than one million animals and approximately US $700 million annually [6]. In addition, at least $23.60 has been spent per treated calf [3].

One of the challenges of bovine respiratory medicine is early detection of clinical cases of BRD. This is especially important in subclinical forms of the disease, which can be easily missed and cause important economic losses [7]. It is generally accepted that early recognition and treatment of BRD improves both prognosis and outcome, while delayed diagnosis and treatment may result in treatment failure [4].

Especially, respiratory disease of young dairy calves is a significant cause of morbidity, mortality, economic loss, and animal welfare concern but there is no gold standard diagnostic test for ante-mortem diagnosis [8].

Diagnosis of BRD

Clinical examination

The clinical diagnosis of BRD classically is based on clinical signs [7]. These signs which are used to make a diagnosis of respiratory disease of calves are fever, cough, ocular or nasal discharge, abnormal breathing, and auscultation of abnormal lung sounds [8]. Different practical tools have been developed for researchers and producers for both beef and dairy calves [7].

Love WJ evaluated clinical scoring systems for BRD. There are some different clinical scoring systems for BRD. The first system values are coughing (induced or spontaneous coughing, 2 points), nasal discharge (any discharge, 3 points), ocular discharge (any discharge, 2 points), ear and head carriage (ear droop or head tilt, 5 points), fever (≥39.2 °C or 102.5 °F, 2 points), and respiratory quality (abnormal respiration, 2 points). Calves are categorized “BRD positive” if their total score is ≥4. This system correctly classified 95.4% of positive cases and 88.6% of controls.

The second presented system categorized the predictors and assigned weights as follows: coughing (spontaneously, 2 points), mild nasal discharge (unilateral, serous or watery discharge, 2 points), and fever (≥39.2 °C or 102.5 °F, 2 points), and respiratory quality (abnormal respiration, 2 points). Calves are categorized “BRD positive” if their total score is ≥4.
points), moderate to severe nasal discharge (bilateral, cloudy, mucoid, mucopurulent, or copious discharge, 5 points), ocular discharge (any discharge, 1 point), ear and head carriage (ear droop or head tilt, 5 points), fever (≥39.2 °C, 2 points), and respiratory quality (abnormal respiration, 2 points). Calves were categorized “BRD positive” if their total score is ≥4. This system correctly classified 89.3% of positive cases and 92.8% of controls. The third presented system using the following predictors and scores: coughing (spontaneous only, 2 points), nasal discharge (any, 4 points), ocular discharge (any, 2 points), ear and head carriage (ear droop or head tilt, 5 points), fever (≥39.2 °C, 2 points), and respiratory quality (abnormal respiration, 2 points). Calves are categorized “BRD positive” if their total score is ≥5. This system correctly classified 89.4% of positive cases and 90.8% of controls. Each of the proposed systems offers few levels of clinical signs and data-based weights for on-farm diagnosis of BRD in dairy calves [6].

**Auscultation examination**

Normally, the thorax of each calf is systematically scanned in each intercostal space from the 11th to the 4th and it is divided into 3 equal longitudinal regions (Figure 1): dorsal, middle, and ventral [9]. If the veterinarian is focus on enzootic bronchopneumonia, she/he should concentrate on the middle and ventral parts of the thorax. Because bovine bacterial bronchopneumonia usually occurs in these locations. The medium and ventral parts of the right (r) and left (l) thorax then are divided into 4 quadrants (Ar/Br/Cr/Dr and Al/Bl/Cl/Dl) that are auscultated using a stethoscope (Figure 1). The presence of abnormal lung sounds including crackles, wheezes, and pleural friction rubs and the absence of respiratory noises should be recorded as abnormal [7].

**Ultrasonographic examination**

Buczinski S have reported the detailed ultrasonographic examination technique in calves with BRD as indicated below. Thoracic ultrasonography has been previously mentioned as a non-invasive ancillary tool for assessing lung lesions and can give information that is complementary to more classical lung function tests (blood gas analysis or spirometric measures). Thoracic ultrasonography has been shown to be highly correlated with radiographic and necropsy lesions [9]. It can be done easily on calf, and therefore has the potential to be used by bovine practitioners and researchers in field conditions [7].

The same area that is ausculted systematically scanned from the 8th to the 4th intercostal space for enzootic pneumonia for use ultrasonographic examination (Figure 1). A total of 8 sites for each side of the thorax are screened for the presence of abnormal ultrasonographic findings. Ultrasonography can performed using a 8.5MHz linear probe that is directly applied on the thorax after 70% isopropyl alcohol could sprayed on the area of interest to improve image quality without clipping. The different anomalies should be noted the presence of comet-tail artefacts (COMT) [7].

**Laboratory tests**

Whole blood and nasal swab samples, nasopharyngeal swab and bronchoalveolar lavage fluid can use for detection of BRD agents with PCR and ELISA techniques [2,5,10]. But periodical monitoring of the infectious agents is not practical, also expensive for a lot of farm.

To improve diagnostic accuracy, several authors have focused on ancillary tests using various blood biomarkers. For example, the acute-phase proteins (APP) change in concentration after infection, inflammation, surgical trauma, or stress and can either increase (positive APP) or decrease (negative APP) as a consequence of inflammatory stimuli before the clinical signs. Haptoglobin (Hp), serum amyloid A (SAA), and fibrinogen (Fb) are among the most commonly reported APPs. The C-reactive protein (CRP) has also been mentioned in various species (eg, human or dog) as an important APP but has received limited interest in cattle. The serum increase of APPs can occur as soon as 4 hours after the insult for SAA and CRP or later (24-48 hours) for Hp and Fb [11].

**Treatment of BRD**

Antimicrobial agents are primarily used to reduce the incidence and severity of BRD, and various registered antibiotics are available for its treatment. Ampicillin, erythromycin, tetracycline, spectinomycin, sulfamethazine, gamithromycin, florfenicol, and tulathromycin are anti-microbial agents commonly used in the treatment of BRD [1,12]. They are generally administered by the oral and/or parenteral routes. However, these treatment applications have several important disadvantages such as systemic side effects, irritation at the injection site, and withdrawal times before slaughtering or
milk ing of animals for human consumption [13]. In addition, developing antibiotic resistance risk of some pathogens is increasing [14]. Joshi have applied relatively new treatment technique for BRD with nebulization. The researchers reported that nebulisation of sodium ceftiofur has more effective treatment when compared with intramuscular injection of the antibiotic in calves with BRD under field conditions.

Prevention

Unfortunately, routine screening of calves for respiratory disease on the farm is rarely performed [8]. The vaccines available to prevent BRD continue to improve [15]. In addition, a nitric oxide releasing solution (NORS) has been developed and shown to have potential in the prevention of BRD [16]. In the other hand, purchasing single-source cattle which known history of pre- and post-weaning procedures can minimize pathogen exposure and enhance immunity. Using cattle-handling techniques and facilities that promote low stress will allow host immune defences to remain effective against bacterial and viral colonization. Also, controlling BRD must be managed through a comprehensive herd health immunization and management program that effectively addresses disease challenges common to the operation [17,18].

Conclusion

In conclusion, BRD is still an important topic and seems to will be serious problem for cattle industry some more time because of its complex etiological structure, difficulties of early diagnostic and treatment situations. One of the negative parts of the situation is improving antibiotic resistance of the pathogens; therefore treatment alternatives are getting decrease. In this frame, prevention and early diagnose of BRD have more importance for future of the cattle industry worldwide.

References

15. Hilton WM (2014) BRD in 2014: where have we been, where are we now, and where do we want to go? Animal Health Research Reviews, 15(2):120-122.