Bovine respiratory disease: management and treatment

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Despite widespread advances in veterinary medicine, diagnostics and therapeutics, bovine respiratory disease (BRD) continues to represent a huge economic cost to both the beef and dairy sectors, with estimates of annual costs in excess of £100 million[1].

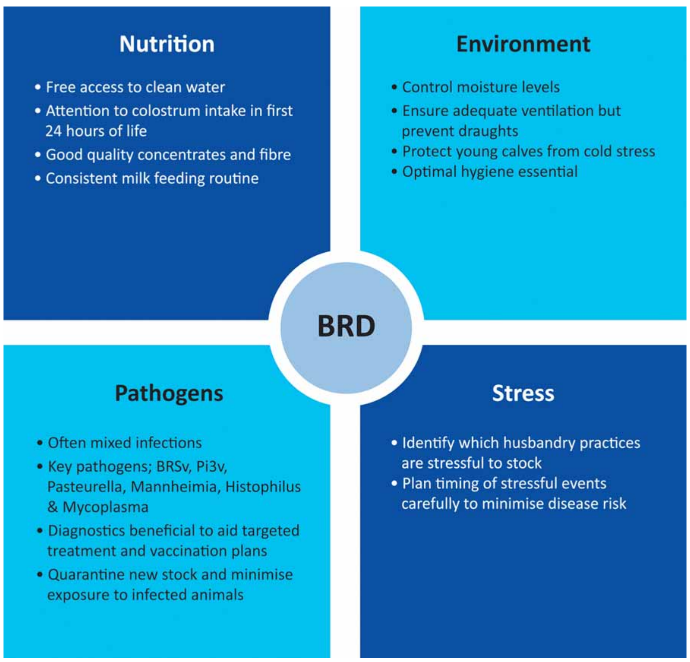

Figure 1. Risk factors for bovine respiratory disease.

Assessing the cost of each individual case is very difficult as a large proportion of the costs associated with BRD are hidden. The direct cost of dead animals, their disposal, medicines, extra labour and veterinary input are easy to quantify, but producers often turn a blind eye to the impact on liveweight gain, feed conversion efficiency and the long-term cost of irreversible lung damage.

BRD has long been recognised as a multifactorial disease, with multiple causative agents and management factors involved in outbreaks. Controlling BRD therefore requires a multi-faceted approach to reduce the challenge while maximising immunity.

Treatment can be effective in reducing losses, but the most cost-effective way to manage BRD has to be through concerted preventive measures.

Management of risk factors

Clinical disease generally develops when there is an imbalance between environmental risk factors, animal factors and a wide range of potential causative infectious agents, including viruses (parainfluenza-3 virus, respiratory syncytial virus, bovine viral diarrhoea and infectious bovine rhinotracheitis), bacteria (*Pasteurella*, *Mannheimia* and *Histophilus*) and mycoplasmas (**Figure 1**).

It is important to consider each of these risk factors holistically, rather than in isolation, to ensure the maximum benefit is achieved. Record analysis should be used to identify trends in morbidity and mortality to determine if there are patterns associated with seasonality, stocking rates, age of affected animals or management practices (**Figure 2**).

This can be used to target interventions, as well as monitor the response to any preventive measures implemented. Disease recording is often incomplete on many units, which represents an opportunity for involvement of the veterinary practitioner.

Calves are born with a naïve, yet functional, immune system. Measures to ensure the development of a strong immune system are essential. Ultimately, calf health hinges on the provision of adequate, good-quality colostrum as soon after birth as possible. It would be prudent for all practitioners to look closely at their producer’s colostrum management practices. Attention to detail with colostrum quality, collection, storage and delivery to calves can have a huge impact on the performance of their stock.

Monitoring failure of passive transfer and recording trends is also key. Precalving vaccination of dams with respiratory vaccines is gaining renewed interest and may be beneficial where BRD is prevalent in neonatal calves. This relies on calf colostral immunity to confer protection. As the calves grow, attention to ongoing nutrition (milk, concentrates and forage) is equally important to maximise immunity levels and growth rates.

Procedures such as weaning, castration, disbudding, TB testing, housing and transport are inevitably stressful and these will adversely affect the animals’ immune system, thus increasing their susceptibility to BRD. Care must be taken to make these procedures as minimally stressful as possible, with quiet handling and consideration of timing.

Environmental conditions have a huge role to play in the susceptibility to and transmission of BRD. Good air quality is paramount, with the added negative effects of dust, excessive moisture and inadequate ventilation, overcrowding and mixing management groups, predisposing animals to BRD.

The effects of cold stress should also not be ignored, with calves subjected to conditions below lower critical temperatures showing increased respiratory disease scores, and requiring a greater number of antibiotic treatments[2]. In these circumstances, the use of calf jackets or heat lamps should be considered.

It is important to consider the source of animals when investigating BRD. Animals may be purchased in an asymptomatic state and may pose a considerable risk for the ingress of new pathogens.

This is particularly relevant with regards to both *Mycoplasma bovis* and persistently infected BVD carriers. The feeding of waste milk has also been reported as posing a significant risk for the spread of *M bovis* in a herd[3].

The first positive step must be to identify which aspects of the system (be it housing or management) are increasing the risk of BRD in the herd. Collection of a thorough history should help identify any calf-rearing practices that are potentially having a negative impact on calf health.

A systematic environmental assessment can then be performed to highlight areas requiring attention (air speed, air movement, moisture, temperature or hygiene)[4].

The environment needs to be considered with regards to the age and number of stock likely to be housed within, as the requirements vary dramatically as the animals mature. For example, the lower critical temperature of a newborn calf is 15°C, whereas by three weeks of age this will have decreased to around 10°C.

A number of tools are available to assist practitioners assessing the suitability of the environment. These include smoke foggers, anemometers, maximum/minimum thermometers and data loggers, which should all be used when the shed is at normal stocking rates.

In today’s economy, a cost-benefit approach needs to be made to improving calf housing. Building a new shed doesn’t always solve the problems – in fact, many new builds are not fit for purpose and vast improvements can often be made easily (at relatively little expense), for example, opening up an air outlet in the roof, creating a wind break/filling in draughty gaps at the bottom of gates or fixing a leaky water trough.

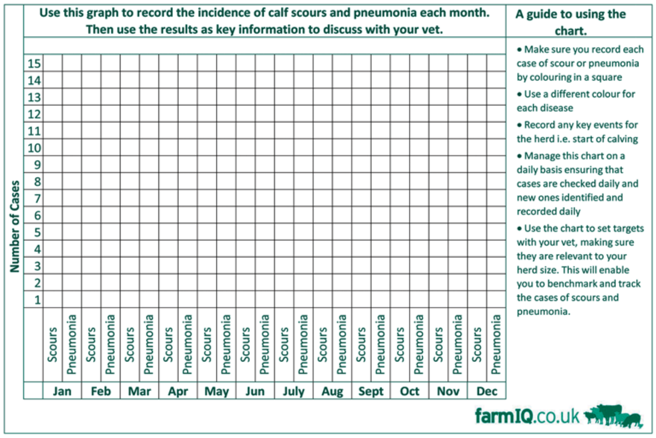

Figure 2. An example of a disease recording form for calf scours and pneumonia.

When considering housing systems, it is worth weighing up the benefits of group housing on social factors – such as increased feed intake and weight gain after weaning – with the reduced risk of disease offered by individual housing options, particularly because the incidence of BRD has been shown to be directly related to group size[5].

Artificial ventilation is becoming increasingly used on units where natural ventilation of the building is inadequate for the age of stock and improvements in natural ventilation are not feasible. These modifications should be considered carefully with the advice of a trained ventilation specialist, but can produce significant improvements in disease challenge.

Conversely, too much fresh air (particularly at high wind speeds) can also be hazardous, creating draughts and chilling calves. Animals must then use extra energy to keep warm, which lowers their immune status and makes them more susceptible to disease[2].

If animals do succumb to disease, producers need to recognise early detection and effective treatment is key to a good outcome. Skilled, experienced stock people are considerably better at detecting calves in the early stages of respiratory disease when clinical signs are often non-specific – for example, depression, reduced appetite and pyrexia – compared to calves that are overtly coughing and breathing heavily with ocular and/or nasal discharge.

Unfortunately, modern farming systems often have a shortage of skilled, experienced labour or have large group sizes with calves on automated feeding systems, which can lead to delay in detection and treatment. Staff training is a great opportunity for practitioner involvement in BRD management.

In these circumstances, the implementation of a calf respiratory scoring system, like the one developed by Sheila McGuirk at the University of Wisconsin, School of Veterinary Medicine6, can assist with the early identification of affected animals.

Treatment options

Because BRD can be caused by a wide range of pathogens, the mainstay of therapy has historically been tailored around broad-spectrum antimicrobial therapy for the treatment of both primary bacterial pathogens and secondary infections following viral insult.

When considering which antimicrobial to use, the following properties should be considered:

- Spectrum of activity: primary pathogens to target include *Mycoplasma haemolytica*, *Pasteurella multocida*, *Histophilus somni* and *M bovis*. Seroprevalence at a herd level for M bovis is more than 30%[6] and in the authors' experience, this pathogen is playing a significant and increasing role in BRD outbreaks[7]
- Onset of action and duration of activity within the target tissue: this is of particular importance in the case of *M bovis* infections
- Ease of administration: dose volume and physical characteristics

In the majority of cases, prescribing decisions will have to be made in the absence of diagnostic results and as such will be based on the unit's history, both in terms of likely pathogens and therapeutic success. Macrolide antibiotics have undergone huge developments and often demonstrate the aforementioned necessary characteristics.

When faced with large-scale BRD outbreaks, practitioners may consider employing antimicrobial metaphylaxis. There is little evidence in literature to suggest a break point at which to move from individual treatment to group level treatment. This decision should be influenced by a number of factors, including group size, severity of disease, new case rate and client expectations/management, while also considering the responsible use of medicines.

NSAIDs are often employed in the management of BRD. Their use will hasten reduction in rectal temperature and is associated with an improved clinical picture and appetite. Data suggests their use may decrease lung lesions at slaughter[8]. In the authors' opinion NSAIDs form an essential part of BRD therapy.

Supportive therapy, for example, fluids and electrolytes, should also be considered for severely affected animals. Appropriate nursing care and biosecurity measures should also be implemented to optimise the outcome.

Diagnostics

Table 1. Diagnostic tests for BRD	
Bacterial culture	Most likely to identify *Pasteurella*, *Mannheimia* and *Histophilus*. *Mycoplasma* grows slowly (7-10 days) and may be missed by routine techniques. *Haemophilus* and *Mycoplasma* may not survive transportation to laboratory.
Immunofluorescence	Most commonly applied to bronchoalveolar lavage samples. Cellular material fixed on to slides and stained with specific antisera. Technically demanding and performance may be quite variable.
PCR tests	Amplify pathogen DNA and RNA and can include both viral and bacterial pathogens. Real time systems offer good sensitivity and specificity. PCR is routinely available from a number of laboratories and packages vary in the number of pathogens included. Can be performed on nasopharyngeal swabs, tissue and bronchoalveolar lavage samples. The most comprehensive package includes all the most common pathogens discussed in this article.
Antibody tests	Most commonly used as a package of viral serology (parainfluenza-3 virus, respiratory syncytial virus, bovine viral diarrhoea and infectious bovine rhinotracheitis), plus *Mycoplasma bovis*. Timing of testing is important and it is often better to test recovered animals (to plan future control strategies). Paired serology (2-4 week) interval if called to an acute outbreak (perhaps in addition to swab samples).

Table 1. Diagnostic tests for BRD.

Diagnosis of infectious disease is almost always based on evidence from history, clinical examination and detection of the organism or the host response to the organism.

BRD is complex and careful evaluation of the significance of both clinical and laboratory findings is always needed.

Care must be taken with tests for the pathogen itself (immunofluorescent antigen detection, PCR and culture) as the primary pathogen may no longer be present by the time the animals are examined or, in the case of some bacteria, may not survive transport to the laboratory (**Table 1**).

With any antibody test (with the possible exception of rising titres in paired samples) exposure to the pathogen is confirmed, but does not indicate when exposure occurred, and in calves of less than nine months old the potential for maternal antibody to be the cause of (low) positive results must be considered.

Diagnostic options play an integral part in the steps taken to prevent future outbreaks, target treatment and tailor vaccination programmes. A range of options are available, but it is the authors' current preference to use pharyngeal swab PCR when acute cases are available due to the high diagnostic rate.

Summary

BRD remains a significant disease syndrome with large economic and welfare implications. Through a systematic approach to identifying and managing the risk factors, together with appropriate treatment, the practitioner can minimise the impact of this disease for their clients.

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