Managing calf pneumonia

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Calf pneumonia is a complex disease that is multifactorial in origin and a common problem in calves worldwide. In the UK, it has been estimated a single case of pneumonia costs a farmer £43.26 per sick dairy calf, with an added cost of £29.58 per calf for the rest of the in-contact group[1].

Table 1. Common pathogens that can cause bovine respiratory disease

Pathogen type	Pathogen name	Commonly referred to as	Pathogen description	Comments
Virus	Bovine respiratory syncytial virus	RSV	Paramyxovirus	Replicates in nasal epithelium Forms syncytia in the bronchial tree
	Parainfluenza 3 virus	PI3	Paramyxovirus	Damages ciliated epithelial cells in the upper respiratory tract
	Bovine herpes-1 virus	IBR	Varicellovirus	Infects respiratory mucosa Lies latent in trigeminal ganglia
	Bovine viral diarrhoea virus	BVD	Pestivirus	Immunosuppressive effects Can lead to persistently infected stock
Bacteria	*Mannheimia haemolytica*	Enzootic pneumonia	Gram-negative, aerobic and facultatively anaerobic	Commensals in the upper respiratory tract
	Pasteurella multocida			
	Bibersteinia trehalosi			
	Histophilus somni		Gram-negative, microaerophilic	Commensal of bovine mucous membranes
	Trueperella pyogenes		Gram-positive, facultatively anaerobic	Commensal of respiratory, gastrointestinal and urogenital tracts
	Fusobacterium necrophorum	Calf diphtheria	Gram-negative, obligate anaerobe	
Mycoplasmas	*Mycoplasma bovis*	Enzootic pneumonia	No cell wall	
	Mycoplasma dispar			
	Ureaplasma species			
Parasites	*Dictyocaulus viviparus*	Lungworm or husk	Trichostrongyle	Particularly seen in first season grazing calves

Table 1. Common pathogens that can cause bovine respiratory disease.

The long-term effects of calf pneumonia in dairy replacements suggest an incidence of pneumonia in the pre-weaning period can lead to a two-week delay in time to first service[2]. This delay has been estimated to cost the producer £1.65 per day[3]. An effect on milk production also exists that can show a 2.2% reduction in first lactation milk yield, which, if we consider a heifer may produce 6,000L in her first lactation[1,2], equates to 132L of lost milk at a cost of 29.70p per litre[4].

By taking this longer-term effect of pneumonia into account, we can correct the actual cost for each case of pneumonia to £105.56. In UK cow-calf units, these costs are £82.10 per affected calf and £74.10 per calf in the in-contact group[1]. It is important to note these estimated costs do not take into account the extra labour costs calf disease may incur on the producer.

Causes

The main factors that cause bovine respiratory disease (BRD) are most often divided into host factors, environmental factors and pathogens:

- Host factors may include nutrition, genetics (breed and conformation), immune system (including colostrum intake and vaccination status) and any concurrent disease[5].
- Environmental factors may include transport, handling, stress, group size, group type, ventilation and humidity[5].
- Although all of these factors can play a role in BRD, a pathogen is required to cause disease. The most common pathogens are listed in **Table 1**.

Housing

Figures 1 (top) and 2. Figures 1 and 2. Stocking density plays an important role in disease transmission. Both understocked and overstocked calf sheds can develop problems.

Housing plays another important role in the spread of disease in young animals[5-9]. Many different calf-rearing systems are used around the world – each with their own problems. When housing calves, it is advisable to group animals in similar age groups. This reduces the likelihood of older calves with better immunity shedding harmful levels of pathogens to younger animals; calves younger than four weeks of age are the most susceptible to respiratory infections.

Mixing of age groups can also increase stress and competition for food and water, as well as bullying by older animals[10]. As well as group type, group size (and, as a result, stocking density) is also highly important for the prevention of disease outbreaks5 (**Figures 1 and 2**).

Highly stocked housing will lead to increased contact between animals, as well as a higher general pathogen load. If housing is not ventilated nor cleaned regularly, higher stocking densities can also predispose to pathogen buildup and increased humidity and ammonia, which has damaging effects on the respiratory system[5,11].

It is recommended calves are kept in group sizes of no more than 12 animals, with fewer than 30 individuals sharing the same airspace in the calf shed[11]. By reducing group size, it also enables better monitoring of individual animals and identification of disease sooner[11]. Although the aforementioned factors are reduced in low stocking density settings, many calf sheds rely on the stack effect to drive ventilation[11].

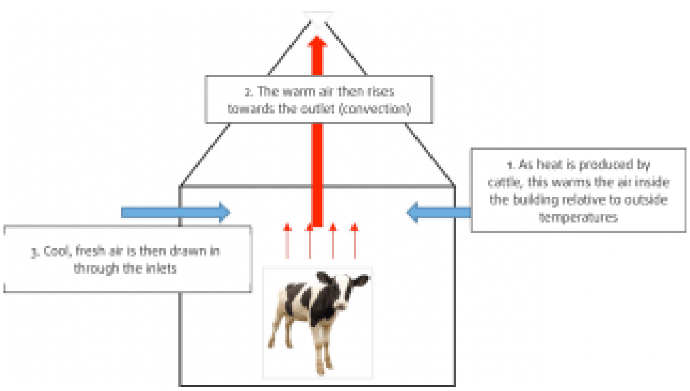

Figure 3. Stack effect.

If an inadequate number of animals are in a shed, they cannot generate enough heat to drive the pathogen-rich air up and out of the building; instead, it cools as it rises then precipitates back on to the livestock below[11]. This will result in high pathogen buildup, which can lead to an increase incidence of disease[11]. Reduced ventilation may also allow the buildup of respiratory sensitisers, such as ammonia[11].

The key to good housing is providing good ventilation. The aims of ventilation are to:

- remove excess moisture and heat

- remove micro-organisms, dust and harmful gases
- avoid draughts

In the majority of cattle buildings, we rely on the stack effect (**Figure 3**) to provide the necessary ventilation. It is important to remember wider buildings are harder to ventilate (the stack effect will start to fail if the building is greater than 25m wide – a steeper pitched roof is better).

Existing ventilation can be improved by some of the following steps:

- adding adequate outlets/inlets
- ensuring correct stocking density for shed size
- installing artificial ventilation (**Figure 4**)
- reducing draughts (ensure wall heights are taller than the height of the calves; **Figure 5**)

Figure 4. Artificial ventilation can be used to improve shed air flow.

Figure 5. Draughts can be reduced with solid, tall sides and pull-down wind curtains.

Figure 6. The presence of cobwebs can be a visual indicator of poor airflow through a building.

When altering inlets, consider the following:

- doors make very poor inlets
- inlets should be twice the area of the outlet and at least 1.5m below the outlet
- inlets should be present along the whole length of the shed
- different materials will allow varying amounts of air through

Assessment of ventilation can easily be performed on farms. It is essential sheds being assessed are filled with the normal amount of stock they would be on any given day. Visual clues to poor ventilation include cobwebs (**Figure 6**) and condensation (tiger striping). The smell of ammonia can also be suggestive of poor ventilation and damp conditions (**Figure 7**).

Figure 7. Automatic feeding areas can be focal zones for the buildup of moisture and pathogens.

The location of the shed, with regards to the prevailing wind, should be assessed; open-fronted sheds should be sheltered from the prevailing wind, whereas it should blow across a pitched roof. Building insulation and roof type should also be considered in an initial assessment.

Smoke bombs can be used to easily track the movement of air flow in a shed. It is best to perform these tests on calm weather days with all doors shut and in a shed stocked normally. An adequately ventilated building should clear of smoke in a few minutes. The path of the smoke is a good way to demonstrate to farmers how airborne pathogens will move within their sheds. If the smoke lingers around the level of the calves, this is what respiratory pathogens will also do.

Diagnostic testing

Table 2. Available diagnostic tests and their uses

Test	Sample required	Time to result*
Virus isolation	Nasal or pharyngeal swab	42 days
Virus PCR	Nasal or pharyngeal swab	14 days
Virus neutralisation test	Blood serum	20 days
ELISA	Blood serum	7 days
Paired serology	Two blood serum samples, 2 to 4 weeks apart	7 days from second sample
Electron microscopy	Nasal swab	15 days
Bacterial isolation	• Nasal, pharyngeal or tracheal swabs • Tracheal wash or bronchoalveolar lavage fluid • Lungs at postmortem	7-15 days
Fluorescent antibody tests	Tissues or cytology preparations	3 days
Postmortem examination	Recently dead (or sacrificed) affected animal	Gross postmortem same day. Histology and further tests will take longer

*Turnaround time taken from the APHA website.

Table 2. Available diagnostic tests and their uses.

Once housing and host factors have been investigated, we can also use various diagnostic tests to identify the causal pathogens. **Table 2** details the tests available and what they are useful for. It is always worthwhile consulting with your local laboratory to discuss the most appropriate tests and samples. To get the right answer, we need to ask the right question.

Test results should be used in conjunction with the clinical picture, as the majority of respiratory pathogens are commensals of the bovine respiratory tract. The prompt treatment of respiratory disease in calves is essential to minimise the effects of disease. It is essential, where possible, we encourage farmers to do everything they can to prevent disease. Alterations to housing or colostrum procedures may be straightforward steps that can be done and should be included in a herd health plan.

If disease does occur then prompt identification and isolation of sick animals may reduce the chances of in-contact animals becoming infected. Prompt and targeted treatment is also important to stop outbreaks occurring.

Numerous vaccines are available for a range of different respiratory pathogens, so by identifying the common cause on each farm, we can tailor-make a vaccination programme that not only matches the disease profile, but also works for the management system on the farm. **Table 3** shows some of the range of respiratory

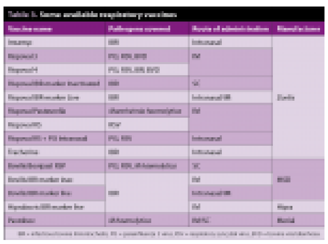

Table 3. Some available respiratory vaccines.

vaccines available.

Conclusion

In the control of BRD, it is vital vets work closely with their clients to ensure all contributing factors are identified. Together, we can then make a plan to include some (or all) of the points aforementioned to prepare a plan to deal with this costly disease.

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