Bovine Respiratory Disease (BRD)

Contents:

Committee

- We would like to acknowledge the committee of National Egyptian Guidelines for Veterinary Medical Interventions, Egyptian Health Council for adapting this guideline.
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Glossary:

BRD: bovine respiratory disease is stress-related common respiratory diseases worldwide that produces signs of severe bronchopneumonia in all ages, particularly young calves.
BP: bronchopneumonia: inflammation of the bronchioles and lung alveoli associated with severe coughing, nasal discharge, fever anorexia and dyspnea.
Dyspnea: is the difficulty of respiration due to inflammation of respiratory tract, congestion f the lining mucosa and narrowing of the lumen. It is manifested as oral breathing or panting (open mouth).
Anorexia: complete loss of appetite manifested by stopping of rumination and ruminal stasis
Fever: increased temp of the animal above the normal limit which is 37.8-39.2 C in ruminant. Fever is manifested as red mucous membranes, dullness, depression.
Stress: any deviation from the optimum condition of animal where a stimulus, internal or external, chemical, physical, emotional, managemental or behavioral stimulates the neurons of the hypothalamus to produce corticotrophin-releasing hormone (ACTH).

Stressors: Factors that stimulate homeostatic, physiological, and behavioral responses in excess of normal (exaggerated response). It could include shipping, transportation, climate change, stocking, dehorning, weaning, and malnutrition.
DART system: include evaluation of the affected calves for the presence of depression (D), anorexia (A), respiratory character change (R), increased rectal temperature (T).

Scope:

The guidelines concerned with diagnosis, treatment and prevention of bovine respiratory disease in young calves and adult ruminant. The guidelines also provided landmarks for evaluation of the severity of the BRD and the most suitable antibiotics for therapeutic intervention.

Introduction

Bovine Respiratory Disease is one of the most common respiratory diseases in cattle. It is the most common cause of illness and death in feedlot cattle. It can be seen in extensively managed beef herds, particularly calves and weaners. The most susceptible animals are beef calves around the time of weaning, between 5 and 8 months of age, and dairy calves younger than 3 months of age. The infection is usually a sum of three codependent factors including stress, an underlying viral infection, and bacterial infection (stress + virus + bacteria). Most BRD cases are of endogenous source caused by the commensal bacteria in the upper respiratory tract at the throat region. The viruses are also carried by the cattle, the most common one of these (IBR) which is a herpesvirus. The disease is usually triggered during or following a stressful period by a viral infection and a subsequent infection of the airways with opportunistic bacteria. This combination of stress factors and infectious agents makes feedlot cattle especially vulnerable. Pasteurella multocida (P. multocida) and Mannheimia haemolytica (M. haemolytica) are the most two common bacterial causes. The initial signs of BRD may start as watery nasal discharges and a soft, tentative cough. As the infection gets worse, a loud, harsh cough and cloudy nasal discharges appear. Then the calf becomes dull, depressed, stand alone, taking short and shallow breaths and may have their neck outstretched to aid breathing. Diagnosis of BRD Complex is made by clinical signs, case history, physical examination. laboratory testing and ultrasonographic examination. Borad spectrum antibiotics or sensitivity based abtibiotic can be used for treatment along with anti-inflammatory, antipyretics and supportive therapy. Prevention of BRD should focus on decreasing the stressors, make sure that calves got the colostrum, and correct the management and environmental factors.

Purpose

The purpose of this multidisciplinary guideline is to improve the opportunities of managing BRD and create executive steps and recommendations to implement these opportunities in clinical practice. Specifically, the goals are to improve BRD diagnostic accuracy,

identify animals that are most susceptible to get the disease, and educate veterinarians the most effective therapeutic interference (the choice of suitable antibiotic, the anti-inflammatory, bronchodilator, supportive therapy). Additional goals are to evaluate the management protocols for control and prevention of BRD spread among farms by early detection and scoring the clinically affected calves.

The target audience.

The guideline is intended for all veterinarians who are intended to diagnose, treat and control individual animals or population in farms affected with BRD.

Main text

- **Definition of BRD**
  BRD or bovine respiratory disease is stress-related common respiratory diseases worldwide that produces signs of severe bronchopneumonia in all ages, particularly young calves.
- **Etiology and risk factors of BRD**
  BRD is a multifactorial disease where different causes are involved in the etiology of BRD including viruses, bacteria, parasites, malnutrition, environmental stressors, and host susceptibility.
  1-**Viruses** commonly associated with BRD Complex are bovine herpesvirus-1 (BHV-1, IBR), bovine viral diarrhea virus (BVD), bovine respiratory syncytial virus (BRSV), parainfluenza-3 (PI-3), and bovine respiratory coronavirus (BRCV).
  2-**Bacteria** are also associated with BRD Complex including *Mannheimia haemolytica* (formerly *Pasteurella haemolytica*), *Pasteurella multocida*, *Mycoplasma bovis*, *Histophilus somni*, and *Trueperella pyogenes*.
  3-**Parasites** – Lungworm can cause irreversible damage to an animal's lungs and can lead on to further respiratory disease if not treated.
  4-**Environmental factors**
  sanitation, ventilation, and overcrowding, and stress events such as weaning, transportation, vaccination, castration, and dehorning, also significantly increase the risk of developing BRD.
  5- Stocking
  A-Mixing Stock – Mixing bought-in stock with current stock can increase the risk of exposure to various different pneumonia-causing bacteria and viruses, which they have not encountered before and therefore have not developed an immunity to.
  B- Overstocking - Can lead to stress and build-up of infection in closely stocked areas increasing the transmission of airborne pathogens.
  5- **Stress factors**: 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.

List of most common viral diseases causing BRD and the characters of each of them

Viral cause of BRD	Characteristic findings
IBR	• Contagious disease affecting cattle causing severe respiratory manifestation as coughing, fever, anorexia, nasal discharge that appear serous then mucopurulent with redness of the nose and necrotic lesions of nasal mucosa. Pneumonia is developed only after secondary bacterial infection
DVD	• Acute, infectious disease causing with bloody diarrhea, high fever, off-feed, mouth ulcers, and pneumonia. Abortion of pregnant cattle usually occurs in sporadic cases.
BRSV	• It is the major cause of bovine respiratory disease in calves during the first year of life. The virus usually causes mild respiratory disease is characterized by coughing, mucous to seropurulent nasal discharge, slight to moderate increased respiratory rates and abnormal breathing sounds. • Moderately affected calves exhibit respiratory rates above 80/min, tachypnoea, harsh lung sounds across most of the lung wall and profound coughing. Generalized symptoms range from slightly elevated rectal temperature, mild CNS depression and anorexia to high fever, deep depression, and coma.
BPI-3	• The virus causes mild respiratory disease of ruminants when it is the only pathogen. • In combination with other pathogenic agents, BPI3V is one of the most significant respiratory pathogens in ruminants. • This virus can cause pneumonia on its own, but it is more generally a part of the etiological complex of enzootic pneumonia. • The clinical signs in calves include fever, lacrimation, serous nasal discharge, depression, dyspnea, and coughing. Some animals may develop bronchointerstitial pneumonia that selectively affects the anteroventral portions of the lungs. • An uncomplicated bovine parainfluenza virus 3 infection runs a brief clinical course of 3–4 days that is usually followed by complete and uneventful recovery. However, stress factors predispose the calf to secondary bacterial infection, especially Mannheimia haemolytica infection. This syndrome is characterized by purulent nasal discharge, cough, rapid respiration, anorexia, fever, general malaise, and substantial mortality from acute fibrinous bronchopneumonia.
BRCV	• pneumoenteric virus that infects the upper and lower respiratory tract and intestine. It is shed in feces and nasal secretions and also infects the lung. • Bovine corona virus is the cause of 3 distinct clinical syndromes in cattle: (1) calf diarrhea, (2) winter dysentery with hemorrhagic diarrhea in adults, and (3) respiratory infections in cattle of various ages including the bovine respiratory disease complex or shipping fever of feedlot cattle

- **Clinical signs of BRD and clinical respiratory scores of BRD**
  - Abnormal behaviors such as depression, lowered head position, head tilt,
  - Dyspnea, ocular or nasal discharge,
  - Fever and anorexia.
  - Many of the clinical signs observed with BRD may also be present with other diseases such as septicemia or gastrointestinal disease.

- **Scoring system and definitions of BRD in calves (McGuirk and Peek,2014) .**

Parameter	Score			
	0	1	2	3
Rectal temperature (°C)	37.5–38.2	38.3–38.8	38.9–39.4	≥39.5
Cough	none	induced-single	induced and spontaneous single (2–3)	spontaneous repeated (>3)
Nasal discharge	serous	small amount, unilateral, cloudy	bilateral, mucus	bilateral, mucopurulent
Head and ear position	normal	ear flick/head shake	slight unilateral ear drop	severe head tilt, or bilateral ear drop
Ocular discharge	none	small	moderate	severe

  - All calves with a rectal temperature ≥39.5 °C and at least one parameter ≥2 were defined as ‘at risk’ for BRD
  - Calves were only defined as diseased (DIS) if the rectal temperature ≥39.5 °C and at least one parameter ≥2 were present for two consecutive days.

Field and laboratory diagnosis of BRD

A-Case definition for BRD by auscultation and ultrasonographic examination

- Case status as a BRD positive calf is determined by thoracic ultrasound and auscultation interpreted in parallel (i.e., a positive diagnosis on at least one of the tests is sufficient to declare the calf as BRD positive).
- Criteria for the diagnosis of BRD are
  - Detection of abnormal lung sounds
  - Ultrasonography: focal or extensive consolidation or abscesses of at least one lesion 2 cm width × 2 cm depth, or any amount of pleural effusion.

B-Sampling suggested for further investigation on etiology of BRD

- Nasal swabs have been used to monitor potential pathogens in a group of cattle or as diagnostic procedures in early clinical respiratory disease.
- Collection technique is very important when using nasal swabs and different types of swabs are necessary for bacterial cultures versus virus isolation.
- Dry cotton swabs are adequate for bacterial cultures.

- Such swabs need to be inserted well into the nasal cavity taking care not to contaminate the swab with the many non-pathogens in the nostrils.
- The swab should then be placed in a prepared transport medium or at least saline or lactated ringers' solution for transport to a laboratory.
- The nasal swab can be used for culture and sensitivity test or bacterial identification. However, bacteria such as Pasteurella hemolytica and Pasteurella multocida may be normally inhabit the upper respiratory tract and they are different isolates after colonization at the lower respiratory tract causing the BRD. Therefore, bronchoalveolar lavage could be a more accurate sample.

C- Summary of confirmatory tests for BRD

1-To assess pulmonary lesions and severity	
Method	**Aim**
Physical examination by auscultation of thoracic cavity at the triangular area of lung	Valuable tools to diagnose the bronchopneumonia of calves to detect the abnormal lung sounds, the increased bronchial sounds or abnormal sound (crackles, wheezes, or absence of sound)
The chest ultrasonography	can demonstrate the comet tail consolidation occurs in the lung that could be unilateral or bilateral
2- For confirmation of etiology	
Polymerase Chain Reaction (PCR) testing methods	can be used to quickly detect viral or bacterial BRD pathogens

- **Treatment for BRD**
  1. Because BRD is caused by a wide range of pathogens, the main objective of therapy is to use broad-spectrum antimicrobial therapy for the treatment of both primary bacterial pathogens and secondary infections following viral insult.
  2. The use of broad-spectrum antimicrobials labeled for bovine respiratory disease is the primary treatment, with macrolides and fenicols mostly used as first-line treatment.
  3. Florfenicol, tulathromycin, enrofloxacin, and danofloxacin have similar efficacy in BRD treatment.
  4. Administration of antimicrobials to cattle to control BRD can be generally classified as therapeutic or preventative, with preventative use further subdivided into prophylactic use and metaphylactic use. The former is the administration of antimicrobials to groups of cattle before the appearance of clinical signs while the latter refers to the administration of antimicrobials to apparently healthy cattle that are in contact with clinical cases.
  5. 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.
  6. 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 optimize the outcome.

7. Veterinarians should carefully evaluate the effectiveness of using antibiotics in treatment and prophylaxis of BRD because malpractice, may lead to increased antimicrobial resistance (AMR).

- **Prevention of BRD**
  1- Sick calves should be isolated from the rest of the herd as soon as signs are reported in worm well—ventilated place (when infectious cause is incriminated)..
  2- Adequate intake of colostrum at the first six hours of life is important to provides the calf with antibodies while the gut wall is still able to absorb them
  3- Routine cleaning and decontamination will aid in the reduction of pneumonia spread at these key communal points in the shed.
  4- Management of risk factors and stress: Care must be taken to make stressful procedures as minimally stressful as possible, with quiet handling.
  5- Veterinarians should recognize the environmental factors contributing to the increased risk of respiratory disease include poor ventilation, inadequate bedding, overcrowding, inclement weather, transportation, and other causes of stress.
  6- Vaccination against respiratory virus is advised from day one till the time of weaning to reduce the spread of viral agents. There are different vaccines that can be used, such as the inactivated pnumo-5 vaccine (against DVD1, BVD2, IBR, PI3, and BRCV). Another type of vaccine is help protect against respiratory disease caused by bovine respiratory syncytial virus (BRSV), infectious bovine rhinotracheitis (IBR) virus and parainfluenza3 (PI3) virus. For dairy herds, INFORCE 3 can be used in calves as young as 3 days old, at weaning, before moving to group pens, or with cows and heifers.
  7- Veterinarian could apply prophylactic doses of antibiotics, especially when the claves are subjected to stress factors (such as shipping or ne introduction into the herd. Prophylactic antibiotics may be used as a means of decreasing acute respiratory disorders for several days after arrival at the feedlot (and to improve growth performance. A subcutaneous injection of 2.5 mg of tulathromycin/kg is effective against protection of BRD in calves.

Recommendations

- ❖ The veterinarian should consider BRD as a highly economic disease as it induced severe economic losses by reducing the daily weight gain of the affected calve, the cost of treatment and veterinary care, and the mortalities. Therefore, he should exert efforts for avoiding the negative consequences of BRD.
- ❖ The veterinarian should obtain a detailed history about the feeding system, the management system, and stocking since malnutrition, environmental stressors can affect cattle susceptibility to catch the disease as predisposing factor.
- ❖ On-farm BRD case definitions with records ensure early disease detection and monitoring of health events.
- ❖ The veterinarian should examine the affected animal to record any signs of depression, drooped head and ears, nasal and ocular discharge, coughing, and labored breathing and dyspnea.
- ❖ The veterinarian should assess the occurrence of BRD in the farm by application of clinical respiratory score, especially in young calf in which the disease is more life threatening.

- The most common viral diseases associated to BRD include IBR, BVD, BRSV, PI-3, BRCV. The veterinarian should be able to clinically identify and differentiate between these viruses to take relevant control measures.
- The veterinarian should be aware of the early signs of BRD. BRD-affected animals have less frequent visits to the feed, and for less time. Therefore, he should immediately start to examine those animals carefully.
- The veterinarian should use the stethoscope for auscultation of lung area which can be a valuable tool for preliminary clinical diagnosis of BRD (specially inflammatory changes with consolidation).
- The veterinarian can recommend the use of more accurate tools for diagnosis by using ultrasonography which is considered as a gold standard examination to confirm lung damage (inflammation, consolidation, abscess).
- If specific infectious disease is suspected, the veterinarian should study the epidemiological status (prevalence, mortality and morbidity rates) in the affected farms.
- In case of specific infectious causes, veterinarian should collect relevant samples from nasal discharge or tracheal swabs and send the samples in ice to the lab. for conducting culture and sensitivity testing for antibiotic of choice that should be used, or to collect blood and serum to make further bacteriological or serological examinations.
- The veterinarian should recommend further etiological identification on nasal or blood samples by performing polymerase chain reaction to confirm diagnosis of certain specific bacterial or viral diseases.
- The veterinarian should conduct a PM examination on dead calves. Cranioventral reddening and firm to hard consolidation of the lung with fibrinous pleuritis are common PM findings in bacterial causes of BRD. While in viral causes of BRD, cranioventral lung appeared red-purple and slightly firm-rubbery.
- The veterinarian should examine the mucous membranes for any change, especially the blue color related to respiratory failure and lung dysfunction.
- The veterinarian should recommend treatment by using broad spectrum antibiotics or based on culture and sensitivity test. Early treatment is recommended to overcome the mortalities and economic losses.
- If infectious cause is suspected, veterinarian should apply strict hygienic measures.
- Vaccination against respiratory virus is advised from day one till the time of weaning to reduce the spread of viral agents. There are different vaccines that can be used, such as the inactivated pnumo-5 vaccine (against DVD1, BVD2, IBR, PI3, and BRCV). Another type of vaccine is help protect against respiratory disease caused by bovine respiratory syncytial virus (BRSV), infectious bovine rhinotracheitis (IBR) virus and parainfluenza3 (PI3) virus. For dairy herds, INFORCE 3 can be used in calves as young as 3 days old, at weaning, before moving to group pens, or with cows and heifers.
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