

Clinico-Epidemiological Studies on Bovine Respiratory Disease and Comparative Efficacies of Different Antimicrobials in Affected Animals

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ABSTRACT

Bovine respiratory disease is a multifactorial disease and the primary cause of both bovine morbidity and mortality. The present investigation was conducted to know the clinico-epidemiological and comparative antimicrobial efficacy in clinical cases of pneumonia in buffaloes brought at VCC, LUVAS, Hisar from different places of Haryana with history like inappetance/anorexia, fever, respiratory distress, coughing and nasal discharge. The study was undertaken for a period of five months i.e. from November 2017 to April 2018. The results showed that maximum cases were recorded from Hisar district in month of February and susceptible age was found to be 2 to 5 years. Haematological findings showed significant neutrophilia and lymphopenia. Moxifloxacin (52.77%) showed better clinical efficacy than ceftiofur, enrofloxacin, cefquinome and other antibiotics (ceftriaxone, oxytetracycline and chloramphenicol), which was determined on basis of clinical recovery and haematological parameters after 5 days of treatment.

Key words: Clinical, epidemiology, Therapeutic efficacy, Antimicrobials, Bovine respiratory disease

INTRODUCTION

Clinical conditions affecting respiratory system are major causes of illness and death in cattle or buffaloes. Diseases indicating respiratory system involvement (i.e., pneumonia, IBR etc.) are classified as bovine respiratory disease.¹⁴ Bovine respiratory disease (BRD) remains one of the most widely studied diseases since many decades. It is caused by interactions of multiple factors like

infectious agents, host factors, environmental stress resulting in bronchopneumonia.⁷ *Mannheimia haemolytica*, *Pasteurella multocida*, *Histophilus somni* and *Mycoplasma bovis* are the most common bacterial pathogens involved in BRD.²³ It accounts for approximately 65-80% of morbidity and 45-75% of mortality in cattle.¹¹ Global economic losses in cattle are approximately >3 billion \$ per year.²⁷

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As the disease is responsible for significant economic losses, exact and timely recognition is very important for its successful treatment.

Viral infection, transportation, overcrowding, rapid change in environmental temperatures and poor air quality are the main risk factors involved in bacterial pneumonia in cattle.⁴ 'Season' is likely to be a risk factor which may vary in different locations such as weather conditions. Clinical signs of BRD are characterized by fever, nasal discharge, coughing, tachypnea, respiratory distress, abnormal lung sounds on auscultation along with marked changes in blood gases.¹⁸ Usually virus infection causes damage to the lung tissue, followed by invasion and growth of bacteria in the compromised tissue resulting in pneumonia and deadly consequences.¹³ Hence the antibacterial treatment is the mainstay in therapeutic management and control of the disease.⁹ Inappropriate administration of nutritional supplements and therapeutic agents is again a common cause of pneumonia in large animals especially in buffalo.¹⁶

Selection of an antibiotic is based upon several factors like culture sensitivity test, price and comparative efficacy of different available antibiotics which could be assessed by randomised clinical trial.¹⁷ A properly designed clinical trial can be effective procedure to check the comparative efficacy of different antibiotics for treatment of a particular disease in a particular region, which may be helpful for field clinicians. Therefore, present investigation aims to compare the efficacy of different antimicrobials in the treatment of pneumonia as well as to know the spatio-temporal pattern of the disease, so that preventive measures and specific therapeutic protocol may be timely suggested.

MATERIAL AND METHODS

A total of 6,516 clinical cases were presented at VCC, COVS, LUVAS, Hisar from

November 2017 to April 2018, out of which 2,811 cases belonged to large animal medicine section which included 1,921 buffaloes. All animals indicating respiratory system involvement during clinical examination were categorized as BRD cases. These cases were further confirmed on the basis of X-rays and haematological examination.

Area: The study was conducted on buffaloes with respiratory affections, brought from different districts of Haryana including Bhiwani, Charkhi Dadri, Fatehabad, Gurgaon, Hisar, Jind, Kaithal, Mahendergarh, Rohtak, Sirsa, Sonapat as well as of Punjab and Rajasthan at VCC, LUVAS, Hisar. The animals were categorized under different age groups ranging from less than 2 years to more than 10 years.

Clinical and Radiological examination: Lung auscultation was performed in all the affected animals. On the basis of history and preliminary clinical examination all the screened animals were subjected to the X-rays evaluation. Lateral view of reticulo-diaphragmatic and thoracic area of animals was examined carefully to investigate pneumonia thereby excluding the foreign body cases.

Haematology: Approximately 5 ml of blood sample was taken aseptically from jugular vein from the animals to evaluate haematological parameters like haemoglobin (Hb), total leukocyte count (TLC), differential leukocyte count (DLC) including neutrophil (N), lymphocyte (L) and monocyte (M) using haematology cell counter (MS4s, Melet Schloesing Laboratories, France). Normal healthy control animal standard values were referred from textbook of ICAR.

Line of treatment: Animals diagnosed with pneumonia/BRD were divided into 5 groups and treated with randomly selected antimicrobials given in Table 1.

Table 1: Therapeutic efficacy of different antimicrobials in BRD affected buffaloes were evaluated as follows:

Groups	Antibiotic treatment given	Dose rate
I (n=126)	Ceftiofur	1.1-2.2 mg/kg b.wt., I/M. x 5days
II (n= 36)	Moxifloxacin	5 mg/kg b.wt., I/M. x 5days
III (n= 15)	Enrofloxacin	5 mg/kg b.wt., I/M. x 5days
IV (n=14)	Cefquinome	1 mg/kg b.wt., I/M. x 5days
V (n=8)	Others (ceftriaxone, oxytetracycline and chloramphenicol),	10 mg/kg b.wt, 10 mg/kg b.wt, and 20-30 mg/kg b.wt., I/M, for 5days; respectively

In addition to antibiotics, supportive therapy in the form of non-steroidal anti-inflammatory drugs (NSAIDs), antioxidants, multivitamins, bronchodilators, steam inhalation and appetite enhancers were given as per case requirement. Clinical efficacy of antibiotics was determined on basis of clinical cure rate as well as of haematological parameters. Clinical cure rate was determined on basis of remission of clinical signs and haematological parameters recorded after 5 days of treatment.

RESULTS AND DISCUSSION

History revealed inappetance in all the affected cases. Clinical findings recorded were increased rectal temperature, nasal discharge, respiratory distress, tachypnea and coughing in all the clinically affected cases. Auscultation of lung area revealed increased bronchial sounds, crackles and wheezes with irregular breathing pattern in severely affected animals. Similar types of findings were also reported by Ozkanlar *et al.*¹⁸, Urban-Chmiel and Grooms²⁴ and Love *et al.*¹⁵

Variation in BRD incidence with year and season have been described in several studies^{8,20,25}. Results of the present investigation showed that maximum buffaloes affected with BRD were presented (Table 1) in the month of February, 2018 followed by December, 2017 *i.e.* winter months. This might be due to extreme changes in weather conditions, which predisposed the animals to bovine respiratory disease. In these extreme weather conditions animals may not get sufficient protection from extreme cold resulting stress and making them susceptible to exogenous and endogenous microbes leading to pneumonia²⁶. Gay and Barnouin¹² in cattle herd; while Verma *et al.*²⁶ in cattle and buffaloes (during December and January) found higher incidence of pneumonia/BRD during winter months. In contrast, Demir and Bozukluhan¹⁰ reported high incidence of cattle pneumonia in the month of April.

Table 1: Spatio-temporal pattern of BRD cases of buffaloes in Haryana, India

Area/Season	November	December	January	February	March	April	Total cases
Bhiwani	5	3	1	4	3	5	21
Charkhi Dadri	1	1	1	0	1	1	5
Fatehabad	4	2	0	3	0	4	13
Gurgaon	0	0	1	1	0	2	4
Hisar	13	17	14	15	17	15	91
Jind	3	4	7	5	3	3	25
Kaithal	1	1	1	1	0	0	4
Mohindergarh	1	1	1	2	0	0	5
Punjab	0	3	1	2	0	1	7
Rajasthan	4	6	6	7	3	7	33
Rohtak	3	4	2	3	2	1	15
Sirsa	2	1	0	5	1	2	11
Sonapat	1	1	2	1	0	1	6
Total	38	44	37	49	30	42	240

Results of present study showed highest prevalence of the disease in 2-5 year age group (52.91%) followed by 6-10 year age group (43.33%). The animals in 2-5 years age group were in their initial two lactations. The lactation stress of the first two lactations in

buffaloes might have been the cause for highest prevalence of pneumonia in 2-5 years buffaloes. The stress is attributed to be one of the predisposing factors for occurrence of pneumonia in cattle and buffaloes¹⁹.

Table 2: Age-wise susceptibility of clinical cases of BRD affected buffaloes

Age (years)	November	December	January	February	March	April	Total cases
<2	1	3	0	0	1	1	6
2-5	23	17	19	23	16	29	127
6-10	13	23	17	26	13	12	104
>10	1	1	1	0	0	0	3

Changes in haematological parameters are often used to determine stresses due to environmental, nutritional and/or pathological factors². Haematological profile (Table 3) showed significant neutrophilia and lymphopenia, which came towards normal range after 5 days treatment. Increased neutrophils might be due to the inflammatory process in respiratory tract of animals suffering with BRD/pneumonia. Another reason might be the risk factors like stress and viral infection which inhibit the enrolment of neutrophils to lungs leaving higher number in blood.⁷ Similarly, high neutrophil count were

also reported by Soltesova *et al.*²¹ This study also showed significant ($p < 0.05$) lymphopenia in BRD affected buffaloes. This could be due to virus-associated modification of the innate and adaptive immune systems.²² Similar findings were also reported by Youssef *et al.*²⁸

On radiological examination, it was found that all the cases selected for this study were having pneumonic changes in lungs and cranioventral portion of lungs was affected severely in most of the cases. In most of the cases, alveolar and interstitial pattern of lungs was observed on radiological examination.

Table 3: Haematological parameters (Mean±S.E.) before and after treatment of clinical cases of buffaloes affected with BRD

Haematological parameters	Healthy Control Values	Diseased animals (0 day), n=240	5 th day (n=199)
Hb (g/dl)	12.50	10.04 ±0.42	12.26±0.62
TLC (10^3 / μ l)	6.70	10.77 ±0.38	7.10±0.81
N (%)	28.70	63.77 ±1.04	32.55±1.22
L(%)	60.60	34.64 ±1.03	55.72±1.10
M (%)	7.80	1.51 ±0.08	1.80±0.05

Randomized clinical trials are recommended for collecting quality data to help in development of therapeutic protocol.³ The antimicrobials treatment regimens used in this study were as per the manufacturers instructions at the time.

In present study, moxifloxacin (52.77%) treated animals showed maximum clinical cure rate followed by ceftiofur (40.47%) group. Maximum clinical efficacy of

moxifloxacin in upper and lower respiratory tract diseases might be attributed to lower minimum inhibitory concentration (MIC), high serum and tissue concentration/systemic bioavailability and much distribution to pulmonary tissues and fluids.^{5,6} Lower clinical cure rate by ceftiofur as compared to moxifloxacin might be due to continuous usage of ceftiofur in different clinical conditions in this particular part of the country

as well as high protein bounding, poor ability to cross physiological barriers or to kill bacteria within cells.¹ Enrofloxacin, cefquinome and other antimicrobials showed

decreased sensitivity which indicates resistance developed by respiratory pathogens to these commonly used antimicrobials.

Table 4: Clinical cure rate of clinical cases of buffaloes affected with BRD (n=199)

	Ceftiofur	Moxifloxacin	Enrofloxacin	Cefquinome	Others*
Treatment given	126	36	15	14	8
Improved	51	19	4	3	3
% cure rate	40.47	52.77	26.66	21.42	37.5

* Ceftriaxone (Out of 5, 3 improved), OTC (2), Chloramphenicol (1)

CONCLUSION

Present study revealed high prevalence of BRD cases in winter season and animal in age group of 2-5 years were found to be most affected. Haematological alterations revealed significant neutrophilia and lymphopenia. On determination of comparative efficacy, moxifloxacin and ceftiofur were found to be maximum effective in clinical recovery of the animals than other antibiotics used in the study. So it can be concluded that moxifloxacin and ceftiofur can be used to treat Bovine Respiratory Disease in field conditions where antibiotic sensitivity facility is not possible.

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