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Clinical management of bovine respiratory disease

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Introduction

Bovine respiratory disease remains a major problem wherever North American cattle are commingled and confined. The North American veterinary literature has reflected this importance with a diversity of reports and papers in scientific journals. The purpose of this presentation is to review the effort some of these papers represent and to attempt a description of bovine respiratory disease (BRD) management in the field.

A total of eight journals; Canadian Veterinary Journal, Canadian Journal of Veterinary Research, Journal of the American Veterinary Medical Association, American Journal of Veterinary Research, Canadian Journal of Animal Science, Journal of Animal Science, Bovine Practitioner, and Preventive Medicine were examined for papers concerning BRD. In addition, selected papers from three or four additional journals were noted. These publications were recorded on an electronic filing system (1).

To search this database, now approaching 5000 citations and covering 1970 to the present, the key words used were BRD, respiratory disease, pasteurellosis, pneumonia, and interstitial pneumonia.

Pathogenesis and etiology

Pathogenesis and etiology remain the predominant preoccupation of researchers, with about 71% of the publications covering experiments and descriptions of what causes and what predisposes to the disease (Table 1).

In 1973, Hoerlein (2) presented the view that BRD was set up by environmental and management stressors, initiated by viruses and complicated by bacteria; most commonly *Pasteurella haemolytica*. In Canada, Jericho (3) used this hypothesis to model BRD in the laboratory enabling a more thorough study of the respiratory disease complex. Yates (4) reviewed the subject in 1984 and noted that *Pasteurella* pneumonia could develop by means other than viral-bacterial synergism. This was in part based on the work by Thomson and others at the Ontario Veterinary College in the early 1970's who published extensively on the role of impaired clearance mechanisms and their association with pasteurellosis (5).

Whether BRD could occur as pasteurellosis without any viral initiators was, and is of course, a critical question to the clinician. The use of viral vaccines in calves destined for the feedlot and in calves placed in finishing yards, has become commonplace. While their efficacy in preventing viral infections is probably well established, their efficacy to prevent undifferentiated respiratory disease is not (6). There are some observations from the Bruce County project (7) that viral vaccination sometimes even increased the treatment rate.

The role of concomitant infections with agents like *Mycoplasma* species or the bovine virus diarrhea virus still stirs controversy amongst clinicians and means there is considerable variation in vaccination recommendations across Canada

Many questions about the pathogenesis of BRD remain unanswered. For example, it has been suggested that nutritional inadequacy, particularly energy, probably participates in some form of "immunoinadequacy" that the clinician observes as an increased treatment rate (8). The role of this so-called immunoinadequacy, more commonly called immunosuppression, needs to be further examined.

The role of concomitant infections with agents like *Mycoplasma* species or the bovine virus diarrhea virus still stirs controversy amongst clinicians and means there is considerable variation in vaccination recommendations across Canada. In addition, the potential influence of group size being commingled is suspected but has not been well established. Recent examinations of the subject have attempted to reduce the issue to a question of whether or not *Pasteurella haemolytica* is contagious or not (9).

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Clinical diagnosis

The literature specific to diagnosis of BRD is limited to 3% of the sample citations followed. Most of the publications listed as "diagnostic" have to do with an enhanced ability to identify putative pathogens. There is scant new information on the diagnosis of BRD in the clinical setting, however the increased scrutiny of pathogenesis at the molecular level has identified mechanisms whereby diagnostic specificity could be enhanced, e.g. zinc uptake and utilization in the affected animal.

Most of the diagnostic developments have occurred "*in situ*" and away from the scrutiny of scientific publication. Computerization in the feedlot industry has demonstrated the value of describing the epidemic curve for BRD as it currently exists in that feedyard. This enables the manager and his veterinarian to project the remaining part of the outbreak and act accordingly. An epidemic curve using a coarse index such as treatment rate can be used to help make a pen diagnosis. The timing of the curve's peak relative to arrival of individual cattle is probably diagnostic as well.

This "rule-in-rule-out" protocol has been widely accepted by the industry, and has meant that the use of the electronic thermometer has become commonplace

Feedlot veterinarians have taught animal health personnel to make a diagnosis by broad categories, often using a body systems approach. Clinically affected cattle are labelled as central nervous system, enteric, musculoskeletal, or respiratory (temperature greater than 40°C) abnormalities. This "rule-in-rule-out" protocol has been widely accepted by the industry, and has meant that the use of the electronic thermometer has become commonplace. It is usually accepted that the sensitivity of the thermometer is high but the specificity low (Harland, unpublished). The use of a pen for animals considered to be chronically affected (chronic pen) has become the most common way to manage those that do not respond to treatment. The rate of non-responding cattle is as closely monitored as the mortality rate. Individual records on all occupants of the chronic pen allow for sorting by projected disposition at weekly or twice-weekly intervals.

The unique identification of all individuals arriving in a feedyard has allowed for some precise epidemiological "snapshotting". Most importantly, this allows for correction by date of arrival and allows a "pure" epidemic curve for BRD to be created from the treatment data. The use of this technique suggests that precise selection of all sick cattle early after arrival is impossible.

The precise diagnosis for each animal treated may not be important for the daily operation of a feedyard, however, it is important when providing animal health management advice. What may appear as BRD by the defined criteria of depression and fever may actually be hemophilosis or a viral disease, which would mean a different disease management strategy. Predictors of lesion severity would also enhance the clinician's diagnostic armamentarium. Probably most important would be the capability to diagnostically measure immune compromise or "immunoinadequacy" either clinically or pathologically.

Table 1. Distribution of topics in the published literature on bovine respiratory disease[a]

Topic	Percentage
Descriptive	26
Etiology	23
Factors influencing BRD	14
Immunization	9
Treatment	9
Microbiological models	8
Diagnostics	3
Prevention	2
New treatments or strategies	1
Resistance to anti-microbials	1

[a]278 citations from 8 journals

Treatment

Only a few publications (Table 1) presented material on the therapy of BRD. There is a general lack of published information on new aspects of therapy, such as treating an entire pen ("blitzing") during an escalating BRD epidemic or high-risk management period. A comparison of the efficacy of the various antimicrobials (10) appears only fairly recently in the literature. There is some comment on the selection of appropriate antibiotics to be used (11). These are largely inconclusive because the assumptions are based on post-treatment necropsy materials (12). Similarly, the use of ancillary therapy for BRD is theoretically described but largely unsubstantiated (13).

Within the feedlot itself, away from published description, some of the greatest gains in therapy may have been made. Formal treatment protocols or written methods of treatment have become part of the routine management of animal health, whether these are tacked on the wall behind the chute or programmed into the "chute-side" computer. A more formal method of treatment allows for a better evaluation of response.

During the late 1970's, treatment of cattle within the pen of origin was discouraged because of the lack of records and second or third day followup. The use of sick pens was commonly described at extension and continuing education meetings. This was widely accepted from a practical or logistical point of view. In some applications, the use of sick pens has become controversial again. Sick pens or a hospital facility provide yet a third level of commingling and therefore also provide an opportunity for dispersal of shed bacteria or, even worse, of resistant bacteria.

Treatment failure

The poor response of calves to treatment is not addressed as an issue in the literature. Less than 1% of the publications examined (Table 1) even describe

Table 2. Reasons why treatments for bovine respiratory disease fail[a]

Wrong diagnosis
Lesion too far advanced
Complicating cause
Insufficient treatment
Bacterial resistance
Aberrant complications

[a]Otto M. Radostits, lecture notes, circa 1971

resistance to antimicrobials. The issue of treatment failure, of course, is critical only to a clinician who probably would not publish his concerns. Therefore, the methodology to examine the situations of treatment failure or poor treatment response are not described. The main reasons for treatment failure probably have not changed over the years (Table 2).

To establish the significance of treatment failure, more precise case definitions or an enhanced capability to make a diagnosis of BRD at all levels are necessary. The literature on the pathology of BRD is usually confined to descriptions or etiological associations (14). The critical question of whether the animals were tested in time (15) or not often goes without comment by most pathologists. Clinicians need help with evaluating resistance to antimicrobials. The most sensitive index of resistance is that of treatment response roughly calculated at the feedlot level. Microbiological laboratories need to develop or define the method that we, as clinicians, should use to present material for susceptibility evaluation.

Control

Historically, vaccination with initiators or bacterial complicators to prevent undifferentiated bovine respiratory disease has been largely unsuccessful (6). Only recently have better bacterins been produced that have shown a sparing effect in field trials (16). Therefore, clinicians have had to resort to other methods of controlling the disease.

Preconditioning calves prior to arrival at a feedyard remains a theoretically good approach to controlling BRD (17). The evidence supporting a reduction in whatever measurement of BRD we choose is equivocal. Much of the benefit of preconditioning undoubtedly lies in getting the calves "on feed." In a somewhat obtuse fashion, the Canadian industry has applied the principle of preconditioning by purchasing calves in January, therefore assuring that many have been weaned, are "on-feed", and have been acclimatized to confinement. From this acclimatization to confinement may accrue the greatest benefit of the procedure.

In the 5th edition of Blood and Henderson, a strong association between the present marketing methods used in North America to move cattle from farm to feedlot and BRD is made. There is some evidence that other marketing alternatives are being examined and used. At the same time there is considerable feedlot consolidation going on. The predominant marketing system in the foreseeable future will still be the auction market method. Even if not, the auction yard may not be the "keystone-in-the-arch" of BRD; commingling is still destined to occur (e.g. in the feedlot) to an even greater degree if feedlot consolidation continues, wherever the calves are purchased.

Mass individual treatment of calves under high risk or incubating disease was first described by Shipper in 1971 (18). Other investigators added weight to the procedure of injecting all in-contact cattle in a pen with an antimicrobial; that would be either therapeutic or prophylactic depending on where the individual calf was on the epidemic curve (19–20). There are few other procedures in food animal practice where the result is so often favorable for the treatment option.

The use of feed additives to prevent or treat BRD would appear to be diminishing. The level of oral antibiotics necessary to control the disease is almost too high and for a variety of reasons the procedure is not efficacious.

The development of effective bacterins for *E. coli* diarrhea in calves and pasteurellosis in weaned calves demonstrates a success story for molecular biology and microbiology

The use of "high-tech" products like interferon has thus far been disappointing and, when measured against conventional methods like mass individual medication, there is almost no cost benefit. Development, however, must continue. There are many immunoenhancers or immunopotentiators that are currently under examination and may eventually find their way into the field. If these natural components were efficacious at a reasonable price, they would have immediate appeal to an industry which has become highly attuned to public perception of food safety.

Immunization

The development of effective bacterins for *E. coli* diarrhea in calves and pasteurellosis in weaned calves demonstrates a success story for molecular biology and microbiology. It took a great deal of background effort to examine in detail the function of these pathogens before a sophisticated "immunogen" could be built.

Currently, Canadian research into respiratory disease pathogens is on the leading edge. Until the group at OVC was able to isolate the leukotoxin and combine it with other components (21), *Pasteurella* bacterins had been notoriously ineffective if not downright dangerous. These ongoing efforts will undoubtedly produce a highly efficacious *P. haemolytica* bacterin. An improved *H. somnus* bacterin is almost higher on the priority list in many calflots than a *Pasteurella* bacterin.

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