Feedlot Session II

"Feedlot Records"

Moderator: **G. K. Jim**

Assessing Antimicrobial Efficacy

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An effective records system can be utilized in a variety of ways in most intensive animal husbandry systems. Individual animals can be tracked to assess diseases they have been treated for as well as the treatments provided to them. The information provided to us regarding disease frequency can guide decision making processes regarding vaccination protocols and prophylactic measures to reduce the impact of these diseases in the future. The records system should also provide us information regarding the antibiotics utilized for treatment of infectious diseases and the length of time the antibiotics were provided to the animal. Information regarding the type of antibiotic utilized and time it was administered to the animal is crucial information for determining if adequate withdrawal time has been achieved and the animal can be safely shipped for slaughter.

Analysis of the records should readily provide you with epidemiological parameters regarding the diseases of importance. Factors such as which animals contract the disease (age and source), what diseases are they treated for and when they contract the problem (days from arrival) can be very important variables when assessing the efficacy of antibiotics.

The records system which has specific information regarding the antibiotics used, dosage and length of treatment can readily be used to study cost efficacy of treatments. This same information can also be readily used by the feedlot for cost computations on groups of animals.

Veterinarians and beef producers must insist on the maintenance of effective records to allow them to guide changes in management. The consulting veterinarian in the feedlot must design treatment protocols for various disease conditions. Respiratory disease remains the most important disease seen in the feedlot and as a result treatment protocols are designed to guide the feedlot personnel in the use of antibiotics for treatment. The question which must be answered is "Which antibiotic possesses the greatest efficacy in the treatment of pneumonia"?. The goal of this presentation will be to demonstrate how the records can be used to effectively assess antimicrobial efficacy in the feedlot. This presentation will concentrate on the assessment of antibiotics in respiratory disease, however the same assessments can be utilized in the comparison of antibiotics in the treatment of other conditions.

At a recent AABP convention a veterinary epidemiologist discussed how the veterinary practitioner could design clinical trials for measuring the therapeutic efficacy of antibiotics.[1] The parameters used to assess antimicrobials in trials can also be used on a day to day basis to study the effectiveness of an antibiotic. Comparisons of antibiotics in well designed clinical trials has provided us with useful information regarding the data that should be collected and how it can be analyzed to provide us with the assessment of antimicrobial efficacy.[2,3]

Before we can carry out an effective comparison there are two requirements that must be fulfilled. First of all we must decide upon the criteria for the inclusion of animals into the respiratory or pneumonia category. These criteria, commonly referred to as the case definition, would exclude other conditions that would detract from the assessment of antibiotic efficacy in the treatment of respiratory disease. The presence of an elevated temperature in the absence of clinical signs referable to the body systems is the most commonly utilized case definition in bovine respiratory disease. Other clinical signs such as an increase in respiratory rate, lack of rumen fill and behavior different from that of penmates will support the diagnosis of respiratory disease. The elevation in temperature remains the only subjective information that we can utilize in the diagnosis of respiratory disease.

The second requirement for effective assessments is establishing a treatment protocol that will be followed without change. The dose, route, and method of administration for the antibiotic must be decided upon. Any deviation from the established protocol will make effective

comparisons difficult. As a part of the treatment protocol a minimum number of days of therapy must be indicated. Frequent changes in antibiotics in the course of a treatment makes the assessment of antimicrobial efficacy almost impossible. The first choice antibiotic should be administered to the pneumonic animal for a minimum of 2 to 3 days to assess the effectiveness of the antibiotic. There is debate concerning the necessity for change to an alternative antibiotic if the antibiotic used initially has not produced a demonstrable drop in the temperature. There is evidence to support the use of the same antibiotic for the first 2-3 days without change even in the face of failure of temperature drop without any appreciable difference in case fatality rate when compared to systems that support the constant change of antibiotics in the treatment period.[2,3] Change in the antibiotic after 2-3 days when the animal has failed to respond with a drop in body temperature can be incorporated into the protocol.

The measureable outcomes in evaluating antimicrobial efficacy include response to initial theapy, relapse rate, cull rates, and case fatality rate. The response to initial therapy will initially be based on the successful drop in temperature to normal at days 3, 4, or 5 depending on the length of treatment established in the treatment protocol. The first level of success would be based on the drop in temperature without the need for antimicrobial change in the required treatment period with no relapse. The second level of success would be gauged on the need for a switch in antibiotics in the initial treatment phase. The length of the initial treatment period can also be utilized to assess the efficacy of the antibiotic. Calculation of the response rate would apply to the period of time in which the assessment was being made.

The rate of relapses or repulls can be calculated for the antibiotic being assessed over the period of time of interest. The relapse is defined as the animal experiencing a second occurrence of UBRD (Undifferentiated Bovine Respiratory Disease) requiring antimicrobial therapy. The relapse with UBRD must fulfill the requirements of the case definition as initially defined. The length of the follow-up period should be defined in establishing the relapse. Is the relapse with respiratory disease in the first 10 days following initial therapy similar to that of the relapse 30 days after the initial treatment period? The relapse 30-35 days after the initial treatment period may well be a function of a new problem rather than a remnant of the initial problem. The length of the follow-up period should therefore be defined in calculating the relapse rate. The relapse rate may be defined as:

$$\frac{\text{Number of animals relapsing after treatment with antibiotic A}}{\text{Total number of animals treated with antibiotic A}}$$

In addition to the relapse rate, the number of relapses that occur in the specified time can also be used to assess the ability of the antibiotic to resolve the problem. The average number of days treated per relapse may also provide valuable information. The length of time from the termination of the initial treatment period that the relapse occurs may serve to indicate the necessity for increasing length of initial treatment for antibiotics that have relapses follow shortly after the conclusion of the initial treatment phase.

Cull rates can be calculated for animals that become chronics and do not respond to therapy. The number of animals placed into convalescent pens for long periods before reintroduction into their home pens following antimicrobial therapy for respiratory disease may also serve to indicate the ability of the antibiotic to resolve infectious conditions of the respiratory tract.

The case fatality rate is a very important assessment of the efficacy. Simply the case fatality rate can be expressed as:

$$\frac{\text{\# of fatal cases first treated with antibiotic A}}{\text{\# of all cases first treated with antibiotic A}}$$

The post mortem examination of the mortalities is important to definitively establish the disease that the animals fell victim to. Was the diagnosis accurate? Did the condition lend itself to treatment with antibiotics? Based on the results of post mortem examination, case fatality rates can be established for cases that died of respiratory disease and for all causes of death in animals treated with the antibiotic being assessed. It will be important to separate respiratory deaths into those that could respond to antibiotics such as bacterial pneumonia and those that would not be expected to respond such as viral pneumonia (deaths due to Respiratory Syncytial Virus for example). Post mortem examination may also provide valuable information regarding the approximate age of the respiratory lesion even though the aging of respiratory lesion is not a precise science. If the age of the respiratory process suggests that initiation of the treatment was late, the antibiotic may be unfairly evaluated. This information will also be important for assessing selection of sick animals in the feedlot.

The best measures for evaluating antimicrobial efficacy are initial response, relapse rate, and case fatality rate. These parameters should be evaluated with respect to treatment for UBRD in days from arrival (days to first treatment). It has been demonstrated that calves treated in the first 6 days from arrival are more likely to relapse than calves treated for the first time after this period of time.[2,3] The ability of your records system to highlight such trends is important in assessing the efficacy of antibiotics and it is also important in understanding the complexities of respiratory disease in the feedlot being examined.

The evaluation of feedlot records provides a more accurate assessment of antimicrobial efficacy than that pre-

dicted by pretreatment samples such as nasal swabs. It has been demonstrated that the success of therapy for UBRD has little relationship to sensitivity patterns of *Pasteurella hemolytica* isolated on pretreatment nasal swabs.[2] This observation likely relates to the problem of comparing efficacy as predicted by *in vitro* tests to that of *in vivo* efficacy. The variability of sensitivity patterns that is seen on pretreatment isolates also makes antimicrobial selection difficult. Records can provide factual information regarding the patterns of antimicrobial efficacy on an immediate basis.

Response rates likely change from year to year but it may be more important to note that they may form in shorter periods of time. The change in outcome measures may be a function of one or all of the following variables: different sensitivity patterns, developing resistance, different pathogens.

Manual (paper) records have limited usefulness for the dynamic situation of the feedlot. They are useful for restrospective analysis, but the analysis is very labor intensive. The greatest drawback to paper records is the lack of immediate information. The advantage of computerized records is that they allow for the timely study of the dynamics of antimicrobial efficacy in the treatment of UBRD.

References

1. Doohoo, I.R., Measuring the therapeutic efficacy of antibiotics: A method for practitioners. Proceedings of 21st Annual Conf. AABP:160-163, 1988. 2. Mechor, G.D., Jim K., Janzen E.D. Comparison of penicillin, oxytetracycline, and trimethroprim-sulfadoxine in the treatment of acute undifferentiated bovine respiratory disease. Can. Vet. J. 29:438-443, 1988. 3. Bateman, K.G., Martin, S.W., Shewen, P.E., Menzies, P.I. An evaluation of antimicrobial therapy for undifferentiated bovine respiratory disease. Can. Vet. J. 31:689-696, 1990.