

A Comparison of High Level Intratracheal Saline Lavage and Conventional Routes of Antibiotic Administration in the Treatment of Acute Bovine Bacterial Pneumonia

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Summary

Antibiotics and medications administered for the treatment of acute bacterial pneumonia in the bovine species can be administered by a number of parenteral routes. The intratracheal (IT) route has been employed by veterinarians in the treatment of tracheal bronchitis and pneumonia for some time in a variety of species.¹

It was found in a recent study in the bovine that a number of antibiotics appeared to be more rapidly absorbed from the lung than from intramuscular (IM) or subcutaneous (SC) injection sites following equivalent dosages. As a result, high and more rapid serum antibiotic concentration peaks were attained. More rapidly declining serum antibiotic levels were also noted, likely due to the lack of drug reservoir at the drug administration site. It was concluded in this experiment that no potentially useful advantage was achieved via the IT route as opposed to IM, SC or IV administration in serum antibiotic concentrations. Normal Holstein steers and bulls were utilized in this study.²

These observations clearly demonstrate that the antibiotics used were well absorbed from lung parenchyma. In order to traverse these tissues and gain access to blood plasma, it is self-evident that the drug must be passing through pulmonary tissue. In other words, the drug assuredly is present at the site of active infection following intratracheal administration. There is less assurance of this following IM, SC or IV routes of administration.

Materials and Methods

The calves and cows reported in this study came from herds in which natural outbreaks of pneumonia occurred.

Paper No. 10922, Scientific Journal Series, Agricultural Experiment Station, University of Minnesota.

The animals ranged in weight from 105 pounds to as high as 1,500 pounds, although most were in the range of 250 to 700 pounds. Following observation and clinical examination, a diagnosis of pneumonia was made based on history, respiratory and heart rates, rectal temperature and the presence of vesicular sounds including rales and coughing on auscultation.

Following a diagnosis of pneumonia, a saline, diluted suspension of an approved antibiotic was prepared by adding the antibiotic to sterile isotonic saline solution. The resultant mixture was administered intra-tracheally at a dosage rate of one millimeter per pound of body weight. No other treatment was used. If good response to therapy was noted, the owner was instructed to continue the course of treatment for three days, by either IM or SC injections with a medication prescribed by the attending veterinarian. If a moderate to poor response was noted, the animals were reassessed and they were either retreated with the same antibiotic or treatment was continued with another approved antibiotic, IT.

The placement of the needle for injection should be done with care using aseptic technique. The needle should be inserted to the right of the most ventral aspect of the trachea in the region of the upper one-third of the cervical trachea avoiding the esophagus. In this region the esophagus is dorsal to the trachea. It is located toward the left of the trachea on the lower one-third of the cervical region. Perforation of the esophagus predisposes to esophagitis. Once the needle is in place, a syringe affixed to the needle will allow air to be aspirated. The Simplex is then attached to the needle and the warmed saline-antibiotic mixture is administered free flow. For the purposes of this study, no potentially irritating antibiotics were utilized due to the already existing tracheitis, bronchitis and pneumonia. Further irritation by antibiotics which have this potential was felt to be self-defeating.

Results

Results of this study are tabulated in Table I. It is noted that complete clinical recovery was recorded in 93%, a fair response was noted in 5% and death occurred in 2% of the animals treated by the intratracheal route.

During the time that this study was conducted, a concurrent evaluation was conducted employing the IM, SC and IV routes of administration for the treatment of bovine pneumonia. Complete clinical recovery was noted in 82%, a fair response in 12% and death occurred in 6% of the treated animals.

Table I

	Intratracheal		Other Routes IM, SC, IV		%
	# Head	%	# Head	%	
Complete Recovery	5226	93	841	82	
Moderate Response	281	5	123	12	
Death Loss	112	2	61	6	
Total	5619	100	1025	100	

Discussion

In the usual sequence of events in exudative bacterial-caused pneumonia of cattle, the etiologic agent enters the respiratory system by the aerogenous route initiating an inflammatory response in the small airways (bronchioles). The inflamed bronchioles become plugged with mucus, neutrophils and cellular debris. This bronchiolar occlusion deprives the associated alveoli of air supply. When the obstruction is complete, collateral ventilation is inadequate and alveolar collapse (atelectasis) occurs.⁴ The capillaries of the collapsed alveoli are then in a state of hypoxia, they lose integrity and protein-rich serum leaks into the alveolar spaces establishing an excellent media in which bacteria gravitating from the affected bronchioles can grow. Incomplete bronchiolar occlusion as well as complete occlusion with the presence of collateral ventilation of alveoli from adjacent, unplugged bronchioles leads to

emphysema (over-distension of alveoli with air). This often progresses to the rupture of alveolar walls which are permanently damaged, thereby greatly reducing alveolar surface area.

Blood circulation through atelectic, consolidated and emphysematous lung tissue is reduced.⁴ This presumably reduces antibiotic levels in affected areas when systemic antibiotics are administered. Chronic bronchiolitis leads to permanent bronchiolar occlusion (bronchiolitis obliterans, bronchiectasis and pulmonary abscessation).

It is suggested by the results of this study that intratracheal administration of antibiotics with high level saline lavage be undertaken as a first choice of treatment of acute bacterial pneumonia in the bovine. This route of administration is an attempt to decrease the mechanical airway blockage at the bronchiolar level. By reducing airway occlusion, atelectasis, alveolar flooding, consolidation, emphysema and permanent bronchiolar damage are averted. This treatment may also tend to concentrate antibiotic levels in affected areas of lungs which have reduced blood circulation.

Bibliography

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