FACTSHEET
A One Health Approach to Antibacterial Efficacy in Animal Health

Antibacterial therapy remains the single most effective intervention in the treatment of specific diseases in animals and is an essential tool for protecting animal welfare. While preventative measures including vaccination are foundational in managing diseases and minimizing antibacterial use in livestock, antibacterial therapy is necessary for those situations where preventative measures fail to provide sufficient coverage. The One Health concept which integrates medical, veterinary and environmental health into a single approach provides a framework for understanding antibacterial use in veterinary medicine. The purpose of this paper is to provide an overview of the efficacy of antibacterials for the treatment of animal diseases by comparison to similar use practices in human medicine.

In veterinary medicine, antibacterial therapy can be broadly categorized into three therapeutic uses (1):

Prevention: there is a known disease risk present and antibacterials are administered to prevent infection of animals.

Control: Disease is present in a percentage of a herd or flock and antibacterials are administered to decrease the spread of disease in the herd or flock while critically ill animals are treated.

Treatment: Antibacterials are administered to sick animals.

Antibacterials may be appropriate used for the prevention of disease in both human and animals at risk for disease development for those situations where other preventative measures have failed or are not effective. In human medicine, the use of macrolides such as erythromycin or clarithromycin is indicated for the preventative uses in pertussis outbreaks, particularly for individuals in high risk groups such as infants and young children or as a primary means of prevention of meningiococcal meningitis (2, 3). In both these scenarios, the use of antibiotics as a preventative measure is combined with vaccination programs for the broader patient population. Moreover, antibiotics are often prescribed for the prevention of urinary tract infections in spina bifida patients where there are few effective alternatives for managing these infections (4). In veterinary medicine, antibacterials such as bacitracin are used for prevention of necrotic enteritis outbreaks caused by *Clostridium perfringens* in poultry (5). In the latter situation, the use of bacitracin reduced overall mortality from 7.4% to 0.4%. Thus, the use of antibiotics in preventive programs are effective tools that must be integrated into an overall disease management program regardless of the patient population.

In those situations where a disease outbreak has occurred with some patients within the population exhibiting clinical signs, the use of antibiotic therapy to treat sick individuals while preventing disease in exposed patients is often referred to as control or metaphylaxis use in veterinary medicine and pre-emptive therapy in human medicine (6). In veterinary medicine, antibacterials are used for the control of bovine respiratory disease (BRD) in feedlot cattle. In this situation, the stress of shipping cattle to feedlots predisposes the animals to pneumonia caused by *Mannheimia haemolytica, Pasteurella multocida,* and *Histophilus somni*. Some of the animals will develop pneumonia within a few days of arrival while others in the group are exposed to the pathogen and will develop disease unless appropriately treated with antibacterials to control the outbreak. For example, an evaluation of the efficacy of the macrolide, gamithromycin, for the control of BRD in high risk cattle at two sites determined that the overall efficacy of gamithromyin was 77.9% and 85.8%, respectively, compared to 58.4% and 35.8% for the saline controls (7).

The use of antibacterials for the treatment of sick individuals is comparable between human and veterinary medicine. For example, first generation cephalosporins such as cephalexin are commonly used to effectively treat uncomplicated skin and soft tissue infections (SSTI) in humans caused by methicillin-susceptible strains of *Staphylococcus aureus* and simple pyodermas in dogs caused by methicillin-susceptible strains of *Staphylococcus pseudintermedius* (8, 9). For example, the efficacy of cephalexin caused by *S. aureus* was determined to be 97% for the treatment of uncomplicated SSTIs in humans compared to 92.3% for cefadroxil for the treatment of canine pyoderma caused by *S. pseudintermedius* (10, 11).

In summary, the use of antibacterials in veterinary medicine has correlate uses in human medicine that provide equivalent levels of efficacy. Moreover, the use of a One Health approach allows for better understanding of the relationship between antibacterial use in human and veterinary medicine. Regardless of whether a clinician is a physician or veterinarian, appropriate, effective antibacterial therapy is an essential tool for insuring patient welfare.

References

1. American Veterinary Medical Association. 2017. Antimicrobial Use and Antimicrobial Resistance FAQ. https://www.avma.org/KB/Resources/FAQs/Pages/Antimicrobial-Use-and-Antimicrobial-Resistance-FAQs.aspx.
2. von Konig, C.-H. W. 2005. Use of Antibiotics in the Prevention and Treatment of Pertussis. Ped. Infect. Dis. J. 24:S66-68.
3. Centers for Disease Control. 1997. Control and Prevention of Meningococcal Disease and Control and Prevention of Serogroup C Meningococcal Disease: Evaluation and Management of Suspected Outbreaks. MMWR. 46:RR-5.
4. Zegers, B., C. Uiterwaal, J. Kimpen, J. van Gool, T. de Jong, P. Winkler-Seinstra, S. Houterman, C. Verpoorten, and C. de Jong-de Vos van Steenwijk. 2011. Antibiotic Prophylaxis for Urinary Tract Infections in Children With Spina Bifida on Intermittent Catheterization. J. Urol. 186:2365–2371.
5. Wicker, D. L., W. N. Isgrigg, J. H. Trammell, and R. B. Davis. 1977. The control and prevention of necrotic enteritis in broilers with zinc bacitracin. Poult. Sci. 56:1229-1231.
6. Pagano, L., M. Caira, A. Nosari, C. Catteneo, R. Fanci, A. Bonini, N. Vianelli, M. G. Garcia, M. Mancinelli, M. E. Tosti, M. Tumbarello, P. Viale, F. Aversa, and G. Rossi. 2011. The use and efficacy of empirical *versus* pre-emptive therapy in the management of fungal infections: the HEMA e-Chart Project. Haematologica. 96:1366-1370.
7. Lechtenberg, K., C. S. Daniels, G. C. Royer, D. T. Bechtol, S. T. Chester, J. Blair, and R. K. Tessman. 2011. Field efficacy study of gamithromycin for the control of bovine respiratory disease in cattle at high risk of developing the disease. Intern. J. Appl. Res. Vet. Med., 9: 184-192.
8. Stevens, D. L., A. L. Bisno, H. F. Chambers, E. P. Dellinger, E. J. C. Goldstein, S. L. Gorbach, J. V. Hirschmann, S. L. Kaplan, J. G. Montoya, and J. C. Wade. Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America. Clin. Infect. Dis. 59: e10-52.
9. Hillier, A., D. H. Lloyd, J. S. Weese, J. M. Blondeau, D. Boothe, E. Breitschwerdt, L. Guardabassi, M. G. Papich, S. Rankin, J. D. Turnidge, and J. E. Sykes. 2014. Guidelines for the diagnosis and antimicrobial therapy of canine superficial bacterial folliculitis (Antimicrobial Guidelines Working Group of the International Society for Companion Animal Infectious Diseases). Vet. Dermatol. 25: 163-e43.
10. Chen, A., K. C. Carroll, M. Diener-West, T. Ross, J. Ordun, M. A. Goldstein, G. Kulkarni, J. B. Cantey, and G. K. Siberry. 2011. Randomized Controlled Trial of Cephalexin versus Clindamycin for Uncomplicated Pediatric Skin Infections. Pediatrics. 127: e573-e580.
11. Six, R., J. Cherni, R. Chesebrough, D. Cleaver, C. J. Lindeman, G. Papp, T. L. Skogerboe, D. J. Weigel, J. F. Boucher, and M. R. Stegemann. 2008. Efficacy and safety of cefovecin in treating bacterial folliculitis, abscesses, and infected wounds in dogs. JAVMA 233:433-439.