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Antibiotics and synthetic antibacterial drugs have revolutionized the treatment of bacterial infections in human and animal patients. These drugs deserve careful use in order to preserve and optimize their effectiveness. Deciding on a treatment plan should begin with the determination of whether an antibacterial drug is indicated; if so, the most appropriate drug should be delivered by the best route at the right dose and duration for the specific type of infection.

In 2005, a consensus statement was published by the American College of Veterinary Internal Medicine (ACVIM) that describes many important concepts related to the topic of antimicrobial drug use; this paper is available at, http://www.acvim.org/uploadedFiles/Consensus_Statements/Antimicrobial.pdf .

Some antibacterial drugs are available over the counter (OTC), which means without a prescription. Other antibacterial drugs are available either by prescription or only through a licensed veterinarian. These drugs may be supplied to equine owners by their veterinarian or administered by the veterinarian. A veterinarian can also write a prescription, and then the drug may be purchased by the horse owner from a veterinary supply store or on-line pharmacy. In all instances, equine owners should consult a veterinarian regarding indications for antibacterial drug use and selection of the most suitable drug. Veterinarians have training in dosing, method

and duration of action, as well as how antibacterial drugs are metabolized and distributed in the body. This knowledge allows veterinarians to select the most appropriate drug or drugs to treat the condition in the horse.

Most people think of antibacterial drugs as having great potential for healing, but consideration must be given to the potential for adverse outcomes associated with the use of antibacterial drugs. These adverse outcomes are rare, but are also difficult to predict and, therefore, difficult to prevent. For example, some horses react to an injection of procaine penicillin with swelling and pain at the injection site, while others can collapse or become hyperexcitable. Other horses may develop severe diarrhea and toxemia when treated with an antibacterial drug due to disruption of normal intestinal flora and overgrowth of pathogenic bacteria; occasionally, the use of antibacterial drugs may result in allergic-type reactions, such as hives, in some horses. Rarely, some antibacterial drugs can result in alteration in numbers of white blood cells or platelets (cells that are important in blood clotting) in the circulation. Lastly, some antibacterial drugs can alter kidney function, especially when used in horses that are fluid-depleted and receiving other types of drugs that can alter kidney function. Although these occurrences are rare, they illustrate the need to think carefully about the consequences of the use of any drug, as few are without the potential to cause side effects under certain circumstances.

When considering antibacterial drug treatment, the cost of treatment, including price of the drug and administration cost, must be considered. The horse's behavioral response to treatment must also be considered when selecting a treatment plan. Some horses can become very difficult to treat based on aversion to oral medication or due to pain at injection sites. This can make completion of a treatment course challenging and thus needs to be taken into consideration when developing and evaluating a treatment plan.

The initial approach to antimicrobial drug selection may be to use a drug or combination of drugs that have worked in similar cases in the past, this is called empirical treatment. In choosing this empirical approach one accepts there will be a delay in making a diagnosis of the specific bacteria causing the problem and subsequent testing to determine the most effective antibacterial drug. It is advisable if the animal fails to respond to empirical treatment or has severe disease then testing to identify the specific cause of disease be undertaken. The susceptibility of the isolated bacteria to various antimicrobial drugs can be tested in the laboratory. Sample collection will depend on the type of infection that is being evaluated. For example, if the horse is suffering from clinical disease consistent with pneumonia, then a sample from the lungs, collected via tracheal wash, would be indicated. In contrast, if the horse has diarrhea and the cause of the diarrhea is being investigated, then a sample of the feces would be submitted to a laboratory in order to identify the cause of the diarrhea. Based on the type of sample, various methods are used in the laboratory to identify the bacteria. Once the bacteria are identified, a decision can be made regarding the need to test the bacteria for

susceptibility to various antibacterial drugs. Some bacteria have very predictable susceptibility patterns while others have patterns that are more difficult to predict, and so each isolated bacterial type needs to be tested in order to choose the best antibacterial treatment plan.

Performance standards for antimicrobial susceptibility testing have been established by the Clinical Laboratory Standards Institute (CLSI). CLSI is an international interdisciplinary nonprofit organization that promotes the development and use of voluntary consensus standards and guidelines within the healthcare community. In many instances, interpretive criteria for the veterinary guidelines are based on human standards, as in vitro ("in glass", meaning in the laboratory) and in vivo (in a living organism) correlations between susceptibility testing results and clinical efficacy are just beginning to be established for the compounds in animals. In addition, data regarding how certain drugs are absorbed and distributed in the animal's body may not be available in some animal species.

Once a specific type of bacteria is isolated in pure culture, it can be tested for susceptibility to a panel of different antimicrobial drugs. The method of testing of susceptibility can vary, depending on the type of organism and the laboratory performing the testing. Results of this susceptibility testing can guide the choice of antibacterial drug should be used to treat the infection. However, there are additional considerations that must be kept in mind when selection of a drug is being made, such as the level of the drug that may be achieved in various sites in the body, potential concerns related to the patient's renal function, and any previously recognized adverse effects associated with antibacterial drug treatment.

Though there is an extensive amount of antimicrobial susceptibility testing done in veterinary diagnostic laboratories throughout North America, the results are usually shared only with the veterinary practitioners submitting the samples. In the past, it was rare for diagnostic laboratories to collate the information on the isolates they tested into a summary report. Only recently have some individual diagnostic laboratories elected to publish summaries of susceptibility patterns of selected equine bacterial isolates.

An important consideration in using antibacterial drugs is the risk for bacterial resistance. Bacteria can become resistant to antimicrobial drugs by a specific non-fatal genetic mutation, or through the transfer of resistance genes from one bacterium to another (within or across genera or families of bacteria).

Transfer of resistance genes, or "acquired resistance," is much more common than mutation.

With the newly acquired resistance genes, the bacteria are more “fit” to survive in an environment in which that particular antimicrobial drug may be present. This leads to a selective advantage over bacteria that do not possess these resistance factors. Resistance genes may be transferred from non-pathogenic bacteria that reside in the animal (for instance, in the digestive tract or nasal passages) to pathogenic bacteria which can cause diseases that are more difficult to treat.

Resistance among bacteria to first-line antibacterial drugs may require the use of newer and more potent antibacterial drugs in order to treat infections. These newer and more potent drugs can be more expensive and are often the drugs suggested to be reserved for the treatment of human infections that are resistant to first-line antibacterial drugs. For example, some isolates of Staphylococcus aureus are resistant to methicillin and other related drugs such as penicillin (these isolates are called methicillin resistant Staphylococcus aureus, or MRSA). Some gastrointestinal bacterial isolates of Salmonella spp. and Escherichia coli have also been found to be resistant to multiple antibacterial drugs.

Antimicrobial exposure appears to select for these resistant populations of bacteria, either transiently or long-term. Bacteria other than the ones that we are hoping to eliminate from the patient can be exposed to the antibacterial drug. For example, bacteria that normally reside in the intestine could be exposed to antibacterial drug that is given to a horse to treat a lung infection; these are called “bystander bacteria.” In one study, normal fecal flora bacteria (bystander bacteria) were found to be more resistant to several antimicrobial drugs when the horses were being treated with antibacterial drugs for various conditions, as compared to other hospitalized horses and horses residing on their home farms. Although these bacteria were not likely to cause disease, they could serve as a source of resistance genes for pathogenic bacteria. The same study found that horses hospitalized, but not being treated with antibacterial drugs, were more likely to have resistant fecal flora than were horses residing on their home farms. The results of this study would suggest that just being in a hospital can lead to some kind of selection pressure on fecal flora. This study, along with others, illustrates that antibacterial drugs should be used only when indicated, and with appropriate product selection and dosing regimen.

For example, antibacterial drugs are not indicated to treat a horse with a fever due to uncomplicated viral respiratory infection. Viral infections cannot be cured with antibacterial drugs. Certainly if the patient has a secondary bacterial infection, antibacterial drugs would be indicated. Additionally, minor superficial wounds that do not involve the joint or tendon can often be managed with prompt, thorough cleansing and bandaging, and may not require the use of oral or injectable antibacterial drugs.

Without question it is preferable to prevent infections as opposed to having to treat with antibiotics or other antibacterial drugs. Implementation of proactive disease prevention protocols can reduce the need for antibacterial drug use by preventing exposure to disease-causing agents and improving the immune response if a horse is exposed to such agents. Good biosecurity practices along with a vaccination program can reduce the risk of infection and need for treatment. Testing of foals' blood to check for adequate passive transfer of maternal antibodies can reduce the risk of infection in neonatal foals, and, therefore, the need for treatment with antibacterial drugs. In the USDA:APHIS:VS National Animal Health Monitoring System's (NAHMS) Equine 2005 study (http://www.aphis.usda.gov/vs/ceah/ncahs/nahms/equine/index.htm), the most common reasons foals and horses were treated with antibiotics were wounds/injury and trauma. Reducing the likelihood of wounds and other traumatic injuries by providing safe housing and fencing, along with optimal hauling and training methods, might reduce the need to use antibacterial drugs in the equine population. Use of vaccination and biosecurity procedures can also reduce the risk of many types of equine infectious diseases. Monitoring horses for signs of illness, along with prompt diagnosis and implementation of isolation procedures, can reduce the risk of spread of contagious disease agents to other horses.

In summary, antibacterial drugs are generally affordable, available and safe; however, careful consideration of the pros and cons of their use is warranted in order to provide the best possible care to horses. None of those involved in equine care would like to envision the loss of the effectiveness of these valuable tools.