Cattle Diseases, Treatments & Tissue Residues

Introduction

Whether young or adult, cattle can be adversely affected by disease leading to decreased production. The diseases of young cattle (dairy or beef) primarily include calf diarrhea and respiratory disease whereas adult dairy cows and beef cattle mostly have problems associated with milk production, reproductive disorders, or lameness.

Calves and Young Cattle

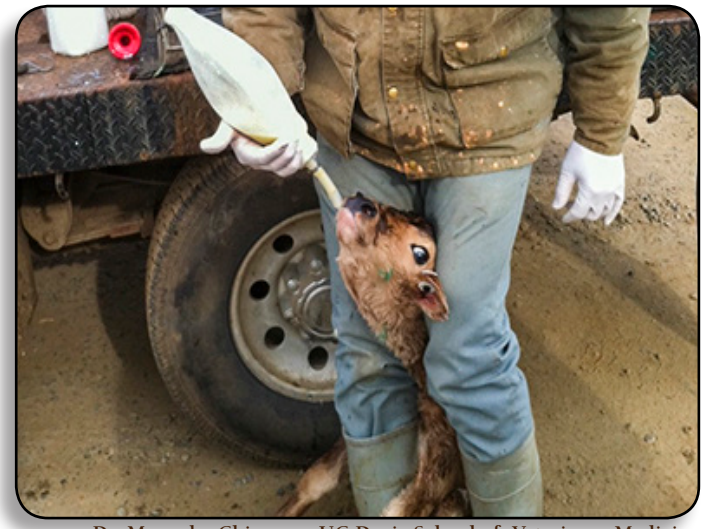
Scours (Calves) Calf diarrhea, or scours, is a very common problem in young cattle. Diarrhea is defined as excessive and frequent passage of watery feces. In severe cases, diarrhea can result in animal debilitation from dehydration and electrolyte losses and may result in death if it is not recognized quickly and treated appropriately. In calves this disease is commonly associated with infection of the gastrointestinal (GI) tract by bacterial, viral, or protozoal agents; however, dietary (nutritional) changes can also result in diarrhea caused by inappropriate feed or feed mixtures for the age of the calf, or even sudden changes in the type of feed. Nearly 25 percent of calves on a given farm may be affected each year, and in severe cases where the disease is not recognized and treated in time, a significant number of deaths may occur.

Calf with Diarrhea

Dr. John Angelos, UC Davis WIFSS

Multiple factors can contribute to a calf developing scours and in many cases more than one of these factors will play a role in the development of the condition. One common factor is inadequate feeding of colostrum following birth. Colostrum is an important source of immunoglobulins (antibodies) that not only act locally in the gut to bind ingested pathogens but also are absorbed into the calf's bloodstream to provide the calf with a ready source of antibodies that are needed to combat infections. Colostrum must be received by the newborn within 24 hours of birth in order to be absorbed systemically. Without this important immune support, calves are much more susceptible to disease, more likely to develop disease, and as a result, much more likely to receive drugs as a form of treatment for disease. Exposure to high concentrations of GI pathogens in the calf's environment is another contributing factor to the development

Feeding Colostrum to a Calf



Dr. Munashe Chigerwe, UC Davis School of Veterinary Medicine

of diarrhea. Virtually every calf is exposed to one or more disease causing agents at some point during early life and mixed infections are common. Diarrheal pathogens can rapidly spread between calves and result in outbreaks of diarrhea.

Bull calves tend to be at greater risk for developing scours than heifer calves because they generally have a lower economic value and may not receive an adequate amount of colostrum immediately following birth. Because most bull calves do not remain in a herd, they are also more likely to be sold multiple times over a short period of time during early life. Such frequent changes of ownership and location, as well as commingling of animals, can put these young, and potentially immunocompromised, calves at a higher risk of exposure to a wide range of infectious agents.

Dr. John Angelos, UC Davis WIFSS

Scours is the most important condition affecting young calves in the dairy industry. Producers are motivated to prevent and treat scours, especially in their valuable heifer calves, as these animals represent the future milk cows that will remain in the herd. Producers count on a supply of healthy heifers every year to replace the dairy cows that will be culled from the herd. According to the National Animal Health Monitoring System, it is common for a significant number of all unweaned heifer calves to be diagnosed with scours, and most of these will be treated with an antibiotic.

Treatment of Scours

When producers treat calf scours, their focus is on replacing the fluids and electrolytes that were lost from the calf's body. Replacement fluids can be delivered by a number of routes, including oral, intravenous, and subcutaneous. Some producers may also administer anti-inflammatory and antipyretic (to treat fever) drugs in addition to fluids. The thought is that reducing fever and inflammation can assist in the healing process.

Jeff Hall, UC Davis WIFSS

Although some of the causative diarrheal agents are not susceptible to antibiotics, most calves with diarrhea will be treated with antibiotics to prevent secondary complications such as septicemia (bacterial infection in the blood) as well as to treat a primary GI infection in the event that the diarrhea is bacterial and is susceptible to an antibiotic. Producers use a variety of antibiotics, delivered by a variety of methods when treating scours. Common antibiotics used for treatment of scours include oxytetracycline, chlortetracycline,

neomycin, and sulfamethazine. Antibiotics can be given either parenterally (by injection), orally (via bolus in the mouth), via medicated milk replacer or by adding it to the water, as long as the manufacturer's instructions printed on the label are followed. Extralabel drug use in feed, including milk and milk replacers, is strictly prohibited.

It is important to know that some infectious causes of diarrhea in calves are zoonotic diseases and can infect people. Whenever working around calves, sick or healthy, it is always a good idea to wear disposable gloves to reduce exposure to possible zoonotic pathogens.

Respiratory Disease

Pneumonia, an inflammation of the lungs can occur in cattle of any age, but the disease is particularly prevalent in housed calves, weaned calves and feedlot cattle. In broad terms, the pneumonias in these groups of animals are classified as 'bronchopneumonias' because the infectious agents that typically cause lung diseases in these age groups gain entry to the body through the airway. In housed dairy calves bronchopneumonia is often referred to as 'enzootic' pneumonia and in feedlot cattle it is called 'shipping fever' because the disease is often associated with recent shipment to a feedlot. These diseases are often also referred to as 'BRD' (bovine respiratory disease) and drug manufacturers will commonly refer to BRD on a list of indications for use of a drug on a manufacturer's drug label.

Yearling Beef Cattle in Sale Yard

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Bacterial and viral agents are both important causes of bronchopneumonias in cattle. In many cases a primary viral infection that involves the airway can also then lead to a secondary bacterial infection of the airway. Common bacterial causes of pneumonia in cattle include *Mannheimia haemolytica (M. haemolytica), Pasteurella multocida (P. multocida), Histophilus somni (H. somni), and Mycoplasma bovis (M. bovis)*. Recently weaned calves or cattle sent to a feedlot are at greater risk for developing pneumonia as a result of multiple factors that include dietary changes, transport to a different location, commingling of new animals, and exposure to new pathogens. Such changes can result in stress in an animal that may also lead to immunocompromise and an increased susceptibility to bacterial/viral infections that cause pneumonia. In severe cases of pneumonia the lungs can become congested and consolidated making breathing and air exchange very difficult for the calf. Some of the early clinical signs of pneumonia in cattle include lack of appetite, depression, a stiff gait and a rough, ungroomed hair coat. Body temperatures can also become elevated. Later in the course of disease an increased respiratory rate with nose or eye discharge and cough are commonly observed.

Regardless of the agent causing the disease, most cattle that develop pneumonia are treated with antibiotics. Common choices for antibiotic treatment of BRD include but are not limited to florfenicol, enrofloxacin, ceftiofur, oxytetracycline, tilmicosin and tulathromycin. These are examples of products labeled for treatment of BRD associated with *Mannheimia haemolytica, Pasteurella multocida*, and/or *Histophilus somni*, and when used appropriately, are quite effective. If the pneumonia is caused by a bacterial infection, antibiotics will help to clear the infection in the lungs. If the pneumonia is viral in nature, antibiotics may help to protect the animal from other secondary bacterial infections that may develop during recovery. Often a nonsteroidal anti-inflammatory drug such as flunixin meglumine is also administered because it can act as an antipyretic (fever reducer). Also, providing a warm, dry environment, making sure that nutritional needs are met, and preventing other illnesses from developing will help support healing and recovery.

Jeff Hall, UC Davis WIFSS

Despite treatment, there are instances when the producer will decide that selling the animal is the best economical option. For instance, a calf with severely affected lungs may never recover completely, and her growth and potential for milk production may be reduced. In these cases, the calf may be sent to slaughter early. If producers do not administer drugs according to manufacturer label directions and then do not keep accurate treatment records to ensure that appropriate drug withdrawal periods are observed prior to sending an animal to slaughter, illegal tissue residues may be detected at slaughter.


Dairy Management Inc.

Adult Cattle

Mastitis

Mastitis is inflammation of one or more quarters of a cow's mammary gland. Mastitis most commonly occurs as a result of bacterial infection of the udder that is caused when bacteria gain entry to the mammary gland through the end of the cow's teat. Although all types of cattle are at risk of developing mastitis, the disease is mainly a concern for the dairy industry because of the direct impact on the quality and safety of milk products sold for human consumption. Treatment for mastitis most commonly involves the use of antibiotics because such treatment can reduce the duration, severity and reoccurrence of the illness. While different antibiotics are administered by different routes such as intravenously, subcutaneously, or intramuscularly, the most frequently used route of antibiotic administration for mastitis is infusion into the gland through the teat end. This method of treatment is called intra-mammary infusion. Antibiotic treatments by any route of administration can result in residues in meat or milk if drugs are not used in accordance with approved label directions or extralabel use requirements under 21 CFR 530.

Inflammed Udder in a Cow with Mastitis

Dr. John Angelos, UC Davis WIFSS

Antibiotics administered through the udder can become absorbed into the bloodstream and circulate throughout the cow's body. Different drugs are metabolized differently and may be stored in different organs or tissues before being completely eliminated from the body. If a cow is slaughtered before the drug residues have been metabolized and excreted, drug residues may be present in tissues. Thus, intra-mammary infusion of antibiotics may lead to drug residues not only in milk, but also other edible tissues. For this reason, approved mastitis antibiotic preparations will have both a milk discard time as well as a slaughter or meat withholding time (withdrawal period) listed on the manufacturer label.

Intra-Mammary Infusion

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While dairy farmers and employees usually remember to hold out the milk of treated cows from the bulk tank, they may forget that a cow treated for mastitis can have a longer slaughter withdrawal period that may be much longer than just the milk discard time. Cows that are sold and slaughtered prior to completion of that withdrawal period are at risk of having detectable tissue residues of antibiotics or other drugs.

Some dairy cows are given an intramammary infusion of antibiotics during the dry period between lactations as a way to help treat stubborn or sub-clinical infections. Antibiotics that are labelled for use during this dry period are called dry cow therapy or dry cow treatment and a cow is said to have been 'dry treated' if she received such treatment at the start of her dry period. Dry cow treatments may have higher antibiotic concentrations in contrast to lactating cow intra-mammary treatments that are designed to be given while the cow is still being milked during her lactation. Dry cow treatments are often also formulated with slow release vehicles such as peanut oil. Another big difference between lactating and dry cow therapies is that dry cow treatments typically have much longer withdrawal periods compared to lactating treatments. If a cow is culled during a dry period, there may be a risk for violative drug residues if that cow had been dry treated.

"Extralabel Drug Use" or ELDU is only permitted under the direction and supervision of a licensed veterinarian within the context of a valid veterinarian-client-patient relationship, who will provide a scientifically based extended withdrawal period. Treating mastitis in an extralabel manner can dramatically increase the risk of violative tissue residues. For instance, infusing a cow's udder with gentamicin, a drug approved for horses, can result in kidney residues for many months!

As is the case for treatment of diseases in all food producing species, if a cow treated for mastitis does not have adequate identification (such as ear tags, leg bands, or neck chains) and the producer does not have complete treatment records, the likelihood of violative tissue residues being detected at slaughter is dramatically increased.

Metritis

In general terms, metritis is an infection and inflammation of the uterus. While there are more specific definitions for the terms 'endometritis' versus 'metritis' depending of the layers of the uterine wall that are involved in the inflammatory process, the term 'metritis' is commonly used to represent both conditions. In cattle, metritis is often characterized by the presence of a foul-smelling, watery vaginal discharge plus a fever. The vaginal discharge originates from the infected uterus and is frequently associated with situations such as unsanitary calving facilities, difficult calvings that required producer or veterinary assistance to resolve, and retained placentas. 'Retained' placenta means the presence of placental tissue attached to the inside wall of the uterus for more than 12 hours after calving.

Cow with Metritis

Dr. John Angelos, UC Davis WIFSS

Although there are FDA approved parenterally (i.e., subcutaneous, intravenous, or intramuscular) administered antibiotics that are specifically labelled for treating metritis, producers will sometimes choose to administer an antibiotic that is approved for treatment of metritis by a parenteral route of administration directly into the uterus. An example is the administration of oxytetracycline (an antibiotic) placed or infused into the uterus. These are examples of extralabel drug use. Performing such extralabel treatment should only ever be done according to policies established by 21 CFR 530 in consultation with the attending herd veterinarian who can assist the producer in determining appropriate milk and meat withdrawal intervals.

Intravenous Drug Administration

Jeff Hall, UC Davis WIFSS

Antibiotics administered directly into the uterus can enter the bloodstream and circulate throughout the cow's body. Some of these drugs can be concentrated in the kidney, an organ that is commonly tested at the time of slaughter for the presence of drug residues. Proper animal identification and treatment records are necessary so that a producer does not forget that a cow has received intrauterine antibiotics and inadvertently send the animal to slaughter prior to the necessary slaughter withdrawal time.

Lameness

Lameness is a very common problem in dairy cows and ranks second only to mastitis in cow health problems.

Footrot One of the most common causes of lameness in both dairy and beef cattle is foot rot. Other names for foot rot are bovine interdigital phlegmon, acute interdigital necrobacillosis, and infectious pododermatitis.

Footrot is caused by a bacterial infection between the digits/claws and is extremely painful. When it is not recognized and treated appropriately, the infection can become deep-seated involving vital structures such as the joints of the digit. Treatment is aimed at controlling the infection and reducing inflammation/ pain with antibiotics and anti-inflammatory drugs.

A variety of different prescriptions as well as over-the-counter antibiotics can be effective against foot rot and include, but are not limited to, penicillin, oxytetracycline, florfenicol, and tulathromycin. Three prescription anti-inflammatory drugs are approved for use in cattle in the U.S.A.: dexamethasone, isoflupredone acetate, and flunixin meglumine (flunixin). Aspirin can also be used for inflammation and does not require a veterinarian's prescription. Flunixin belongs to the class of drugs known as non-steroidal anti-inflammatory drugs and is only approved for intravenous use. To help control foot rot on a dairy, foot baths containing disinfectants are routinely used in alleys that cows must walk through as they exit the milk parlor.

Lame Cow with Sore Right Front Leg

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Foot Rot Between Toes on Cow's Foot

Dr. John Angelos, UC Davis WIFSS

Hairy Foot Warts Hairy foot warts are another extremely painful condition that cause lameness in dairy cows. The lesion usually has wart-like hairy growths that arise from the skin surface or may be less wart-like and appear more red and raw. Thus, other names include hairy heel warts, strawberry heel warts, digital dermatitis, and papillomatous digital dermatitis. Cows with these growth can be extremely lame, however the skin growths may not look that severe.

It is believed that hairy foot warts are caused by a type of bacterium that thrives in wet conditions commonly found on dairies. Fortunately, the disease can be controlled through the application of topical antibiotics. Since hairy foot warts are easily transmitted between animals through use of common hoof trimming equipment the disease can be prevented by disinfecting hoof trimming equipment used on cases of suspected hairy heel warts and between dairies.

Hairy Foot Wart on Heel of Cow's Foot

Dr. Dusty Nagy, University of Missouri,

Subacute/Chronic Laminitis One of the most important causes of lameness in dairy cows is laminitis - inflammation of the laminae (the living part of the hoof wall that is responsible for growth of the hoof wall). The underlying cause of laminitis in dairy cattle is brought about by the dietary changes created during the transition from the pre-calving diet (the dry cow diet) to the post-calving diet that is more carbohydrate-rich.

The list of potential hoof problems that result from laminitis do not usually develop suddenly and so these problems are said to come about because of 'subacute' or 'chronic' laminitis. Some hoof problems that can result from laminitis in dairy cows include: sole hemorrhages, slipper feet, widened and flattened hooves with horizontal ridges that form fissures and full thickness wall breaks, softer-than-normal 'powdery' sole horn that is easily traumatized, sole abscesses, shallow heels, sole ulcers, white line 'disease', white line abscesses, and heel erosions. While some of these individual diseases are treated with antibiotics and anti-inflammatory drugs and managed with hoof trimming and supportive measures, the best prevention for laminitis is proper management of the cow's diet.

Sole Bruising and Abscess from Subclinical/Chronic Laminitis:

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Tissue Residues and Cattle

In all species and all classes of food animals, the principal cause of all violative residues is a failure to allow adequate time for livestock drugs to be metabolized and excreted. Common circumstances which can lead to an inadequate "withdrawal period" can be grouped into three general categories:

Inadequate animal identification and/or amimal treatment records It is important for farmers to have established control systems in order to avoid drug residues in meat and/or milk. Inadequate animal ID can lead to the wrong animal being marketed. Inadequate records can result in inadvertently sending treated animals to market earlier than the established withdrawal period or adding milk from a treated cow into the bulk tank.

Lynn Betts, NRCS

Failure to follow the label directions A rigorous drug approval process is a major safeguard that protects consumers of livestock products from drug residues. Part of that approval process includes an FDA-approved label. Drug labels include specific directions on how the drug should be used, the conditions for use, the route of administration, the slaughter withdrawal period and a milk discard time if appropriate.


Jeff Hall, UC Davis WIFSS

FDA definitions for veal calves and non-lactating cows become very important when following label directions. For example, if pre-ruminating veal calves are given colostrum or milk from a cow who was treated with drugs prior to calving, the calf may receive residues of drugs prescribed for ruminating cattle. This can lead to residues in the bob veal calf if sent to slaughter within three weeks of birth. This is an especially important consideration if colostrum/milk from treated cows is comingled and fed to all calves. Another example is that replacement heifers are considered to be "non-lactating dairy cattle" because they have not yet had a lactation, while adult dairy cows that have already had one lactation cycle, but that are in the dry period of their cycle, are classified as dry dairy cows and not as non-lactating dairy cattle. The withdrawal period may be different between these two cow classifications.

An important difference between dry and lactating therapy is the duration of time following drug administration that a dairy producer must wait before the milk from that cow is allowed to be sold for human consumption. This period of time is very prolonged for dry cow therapies and typically extends past the initial milkings of colostrum following calving. Failure to follow the directions for dry and lactating therapy witholding times could lead to residues in the milk.

Failure to follow requirements for extralabel use When drug use deviates from explicit label directions, the time that the drug persists in the tissues and milk can also change. There are legitimate reasons for deviations from label directions by a veterinarian. This practice is called "Extralabel Drug Use" or ELDU. Because of the risk for violative drug residues, on-label treatment should always be the producer's first choice. Extralabel treatment should be a treatment of last resort and only done under the supervision of a veterinarian in accordance with 21 CFR 530. Under 21 CFR 530 ELDU requires there to be a valid Veterinarian-Client-Patient Relationship and extended veterinarian-provided withdrawal periods based on scientific evidence. According to 21 CFR 530.12, the veterinarian must provide an ELDU label for the drug being used that includes the class/species identification of the animal(s) being treated; dosage; frequency; route of administration; duration of therapy; the extended meat withdrawal period and the extended milk discard time based on scientific evidence. When the ELDU directions provided by a veterinarian are not followed, a violative residue may occur in milk or meat.

In cases where drugs are being used in an extralabel manner, veterinarians are also required to keep specific records in accordance with 21 CFR 530.5. The records must include:

1. The established name of the drug and its active ingredient, or if formulated from more than one ingredient, the established name of each ingredient;
2. The condition treated;
3. The species of the treated animal(s);
4. The dosage administered;
5. The duration of treatment;
6. The numbers of animals treated; and
7. The specified withdrawal, withholding, or discard time(s), if applicable, for meat, milk, eggs, or any food which might be derived from any food animals treated.

A veterinarian must keep all required records for two years or as otherwise required by Federal or State law, whichever is greater. Also, any person who is in charge, control, or custody of such records shall, upon request of a person designated by FDA, permit such person designated by FDA to, at all reasonable times, have access to, permit copying, and verify such records.

Acknowledgements

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References:

Beef 2007-2008; Part I: Reference of beef cow-calf management practices in the United States, 2007-08. United States Department of Agriculture; Animal and Plant Health Inspection Service; Veterinary Services; National Animal Health Monitoring System

Goats: Penn State Extension. Accessed May 18, 2014.
http://extension.psu.edu/animals/goats

FACT SHEET: Feedlot Finishing Cattle. Accessed July 22, 2014.
http://www.beefusa.org/uDocs/Feedlot%20finishing%20fact%20sheet%20FINAL_4%2026%2006.pdf.

Oklahoma State University Breeds of Livestock: Goats. Accessed May 20, 2014
http://www.ansi.okstate.edu/breeds/goats/

Greiner, SP. Beef Cattle Breeds and Biological Types. Virginia Cooperative Extension. Publication

Final Rule: Traceability for Livestock Moved Interstate; Accessed July 22, 2014.
http://www.aphis.usda.gov/newsroom/2012/12/pdf/traceability_final_rule.pdf

Food Animal Residue Avoidance Databank. Accessed July 22, 2014.
http://www.farad.org/regulatory/useclass_cattle.asp

Modern Beef Production Fact Sheet. Cattlemen's Beef Board and National Cattlemen's Beef Association. Updated 9/2009. Accessed July 21, 2014.
http://www.explorebeef.org/

Dairy 2007. Part I: Reference of Dairy Cattle Health and Management Practices in the United States, 2007. USDA. APHIS. Veterinary Services. National Animal Health Monitoring System. October 2007. http://www.aphis.usda.gov/animal_health/nahms/dairy/downloads/dairy07/Dairy07_dr_PartI.pdf