TEXAS A&M AGRILIFE EXTENSION

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ANAPLASMOSIS IN BEEF CATTLE

Anaplasmosis is an infectious disease of cattle that causes destruction of red blood cells. The disease is caused by a minute parasite, Anaplasma marginale , found in the red blood cells of infected cattle. It can be transmitted from infected animals to healthy animals by insects or by surgical instruments.

Stages Of The Disease

Anaplasmosis can be divided into four stages: incubation, developmental, convalescent, and carrier. These stages and the symptoms associated with them are described below.

Incubation Stage

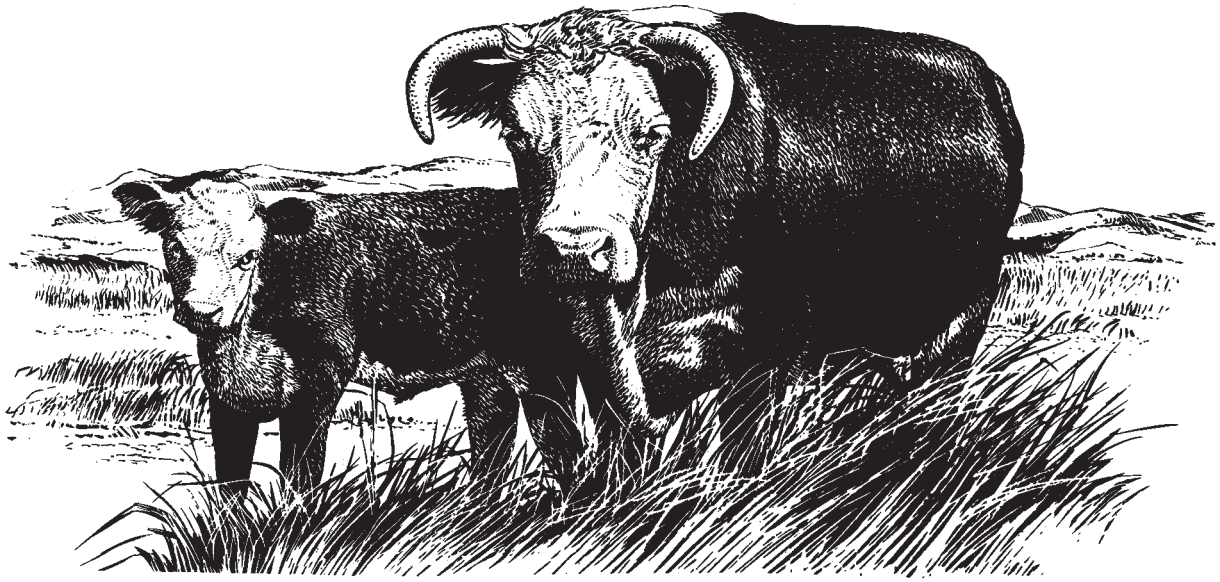
The incubation stage begins with the original infection with A. marginale and lasts until 1 percent of the animal's red blood cells (RBCs) are infected. The average incubation stage ranges from 3 to 8 weeks, but wide variations have been documented. Most variation is directly related to the number of organisms introduced into the animal.

After gaining entry into a susceptible animal, the anaplasma parasite slowly reproduces in the animal's blood during the incubation phase. During this period the animal remains healthy and shows no signs of being infected. Finally, after the parasite has reproduced many times and established itself in the RBCs of the animal, the body attempts to destroy the parasite.

Developmental Stage

During the developmental stage , which normally lasts from 4 to 9 days, most of the characteristic signs of anaplasmosis appear. Clinical signs begin to be expressed about halfway through this phase. As the infected animal's body destroys the parasite, RBCs are destroyed as well. When a substantial loss of RBCs has occurred, the animal will show signs of clinical anemia. The body temperature will commonly rise to 104 º to 107º F (40 º to 41º C), and a rapid decrease in milk production will occur in lactating cows.

Cattle producers first notice the anemic, anaplasmosis-infected animal when it becomes



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weak and lags behind the herd. It refuses to eat or drink water. The skin becomes pale around the eyes and on the muzzle, lips, and teats. Later, the animal may show constipation, excitement, rapid weight loss, and yellow-tinged skin. The animal may fall or lie down and be unable to rise. Affected cattle either die or begin a recovery 1 to 4 days after the first signs of the disease.

As a general rule, unless infected cattle can be detected during the early developmental stage, they should not be treated. There are two primary reasons for this practice. First, if the animal is forced to move or becomes excited, it may die of anoxia (lack of oxygen in the animal's system). Second, antibiotic treatments do little or nothing to affect the outcome of the disease when given during the late developmental or convalescent stage.

Convalescent Stage

Cattle that survive the clinical disease lose weight, abort calves, and recover slowly over a 2- or 3-month period. This is known as the **convalescent stage**, which lasts until normal blood values return. This stage is differentiated from the developmental stage by an increase in the production of RBCs (erythropoiesis) in the peripheral blood, shown in an increase in hemoglobin levels and high total white blood cell counts, among other characteristics. Death losses normally occur during the late developmental stage or early convalescent stage.

Cattle of all ages may become infected with anaplasmosis, but the severity of illness increases with age. Calves under 6 months of age seldom show enough signs to indicate that they are infected. Cattle 6 months to 3 years of age become increasingly ill, and more deaths occur with advancing age. After 3 years of age, 30 to 50 percent of cattle with clinical anaplasmosis die if untreated.

Carrier Stage

Unless adequately medicated, cattle that recover from anaplasmosis remain reservoirs (carriers) of the disease for the rest of their lives. During the carrier stage, an animal will not exhibit any clinical signs associated with the persistent low-level *A. marginale* infection. Nevertheless, the blood from these recovered animals will cause anaplasmosis if introduced into susceptible cattle. Carriers very rarely become ill with anaplasmosis a second time. Unidentified carriers in a herd are the most likely source of infection for future outbreaks of the disease.

Disease Outbreaks

Anaplasmosis outbreaks are related to the lack of a control program, the ratio between anaplasmosis carriers and susceptible animals in the herd, and the amount of vector transmission.

Outbreaks = No Controls + Carriers + Susceptible Animals + Vectors

An increase in the ratio of carriers to susceptible animals or an increase in vector transmission can influence the severity of an outbreak. With these factors in mind, the producer needs to consider reducing vector transmission, developing control programs to prevent outbreaks, eliminating the carrier state, and using treatment or management options available to stop an outbreak of anaplasmosis.

Knowing how to interpret anaplasmosis outbreaks can yield valuable information on necessary changes in management. Outbreaks occurring during the vector season would indicate infection of susceptible cattle and acute outbreaks of anaplasmosis. If this situation occurs, preventative measures, such as vaccinations or antibiotic therapy as outlined in later sections, should be implemented.

If outbreaks occur during the winter months, they are due not to recent infection of the susceptible cattle but to stress, which can lead to expression of the disease in infected cattle. In this situation, vaccination would not prevent further outbreaks during this non-vector season. Vaccination works to prevent acute expression of the disease upon infection during the initial exposure. It does not prevent infection or the development of a carrier animal. Antibiotic therapy can be used to control this type of outbreak as described later in the section "Control Programs for Anaplasmosis."

An additional strategy is preventing stress in susceptible cattle. Nutrition and environmental stress are two areas that must be managed closely in suspect herds. An increase in outbreaks during a non-vector season would indicate that stress is a key factor in the expression of symptoms.

Reducing Vector Transmission

Anaplasmosis is spread by the transfer of blood from an infected animal to a susceptible one. Primarily, the transmission is "mechanical"—that is, it is transmitted by the mouth parts of biting insects contaminated with *A. marginale*-infected blood or by contaminated instruments used by human beings.

Three biting insects (horse flies, stable flies, and mosquitoes) are known to transmit anaplasmosis mechanically by carrying *A. marginale*-infected RBCs from diseased cattle to susceptible cattle.

In general, if more than 5 minutes elapse between the time when an insect bites a diseased animal and the time it bites a susceptible animal, anaplasmosis is not transmitted. The disease is more likely to be transmitted by insects when cattle gather together, making it easier for insects to bite several animals in a short period of time. Anaplasmosis spreads easily between herds when neighboring cattle congregate under shade trees along fence lines.

In addition to insect vectors, anaplasmosis organisms can be transmitted from one animal to another by means of the equipment used to work the cattle. The way the disease progresses through the herd can indicate whether insects or instruments are primarily responsible for the disease outbreak. When the disease is transmitted by infected instruments, a large number of cattle in the herd will show signs of anaplasmosis 4 to 6 weeks after the cattle have been processed. This kind of outbreak appears suddenly, without any earlier clinical cases being observed. Instrument-based transmission can be easily prevented by careful handling of dehorning saws, castrating knives, vaccinating and bleeding needles, tattoo instruments, and ear notches contaminated with *A. marginale*-infected blood. Changing needles between animals and a quick rinse of contaminated instruments in clean water or disinfectant immediately after use will usually prevent transmission.

In contrast, when insects are the mechanical vectors of the disease, a few cases usually occur first and then are followed 4 to 6 weeks later by another "wave" of clinical disease. The first cases are caused by the biting insects transmitting the disease from the healthy carriers in the herd to susceptible animals. The second wave of cases is caused by insect vectors carrying the disease from the earlier sick animals. The clinically ill animal is usually down and very weak; it makes no attempt to fight off the biting insects. In reality, the sick animal is prime eating for the blood-feeding insects. The blood of a clinically ill animal is 20 times more infectious than the blood of a healthy anaplasmosis carrier.

In the past, ticks have been looked upon as one of the less important vectors, but new information leads us to believe that ticks may be major transmitters of anaplasmosis in some areas. Researchers have demonstrated that the Pacific Coast tick and the Rocky Mountain wood tick (*Dermacentor occidentalis* and *Dermacentor andersoni*, respectively) can be transmitters of the disease. The *A. marginale* parasite may be passed through several developmental stages of ticks and then be transmitted to susceptible cattle. Insect vectors that transmit disease in this manner are known as "biological vectors." Biological vectors may transmit the disease months and perhaps years after biting an infected animal.

Control of biting insects, especially the large biting flies, can often be frustrating and is generally not a practical, reliable method for totally preventing transmission of anaplasmosis. However, applications of insecticides that reduce the biting insect population will substantially reduce the number of clinical anaplasmosis cases occurring in a herd. Periodic spraying and dipping, as well as forced use of dust bags and back rubbers, are common methods of insecticide application for beef cattle.

Under some grazing programs, the most practical way to prevent exposure is to graze cattle in areas where the vector population is low. Identify areas where biting fly populations are low and graze cattle in these areas during late spring and summer. Utilize areas where fly populations are high for fall and winter grazing and feeding. This is not practical for all operations, but, when feasible, it should be given careful consideration.

Eliminating The Carrier State

Anaplasmosis carrier cattle may be cured of the infection by treatment with certain tetracycline antibiotics. Carrier-state elimination programs must include post-medication serologic testing. The animal may test positive for several months after treatment ends, but the positive reactor's blood may not be infectious to susceptible animals. When testing 6 months after treatment ceases, all test-positive reactors

should be considered as "treatment failure." Failures should be retreated or separated from the rest of the herd. Animals cleared of the carrier state are susceptible to reinfection, but these animals will exhibit resistance to clinical anaplasmosis for as long as 30 months.

Possible antibiotic treatment protocols for eliminating the carrier state are described below:

Oxytetracycline (50 to 100 mg/ml): 5 or 10 day treatment. 10 mg per pound of body weight (BW) daily for 5 days or 5 mg per pound of BW for 10 days.

Intramuscular: To ensure adequate absorption of the medication and prevent excessive muscle inflammation, do not inject more than 10 ml per injection site.

or

Intravenous: Oxytetracycline should be diluted with physiological saline or administered by a veterinarian.

Oxytetracycline (LA-200): 4 treatments at 3-day intervals.

Each animal receives 4 treatments of LA-200 at 3-day intervals at a dosage of 9 mg per pound of BW. The total dose should be divided between two injection sites and given by deep intramuscular injection.

Chlortetracycline: 60-day treatment.

Chlortetracycline fed at a level of 5 mg per pound of BW daily for 60 days will eliminate the carrier state of anaplasmosis. Oral administration permits treatment on a herd basis and the use of economical antibiotic premixes.

Chlortetracycline: 120-day treatment.

Chlortetracycline fed at the rate of 0.5 mg per pound of BW per day for 120 days will eliminate the carrier state of anaplasmosis.

Attempts to eliminate the carrier state of anaplasmosis by feeding chlortetracycline at the rate of 1 mg per pound of BW every other day for 60 feedings (120 days) did not consistently rid animals of the *A. marginale* infections.

Note: Programs for the elimination of the carrier state should be conducted after the vector season has ended.

Control Programs For Anaplasmosis

Test the herd and separate carriers from non-carriers. This program requires blood testing and identifying each animal in the beef herd as a carrier of the disease or as susceptible to the disease. It also requires maintaining two separate herds during the vector season or disposing of one group (carrier animals or susceptible animals).

When the carrier incidence is high within a herd, it may be advantageous to maintain a 100-percent carrier herd. However, new additions to the herd must be protected from clinical anaplasmosis by vaccination or antibiotic medication until adequate immunity is achieved (see the section "Administer anaplasmosis vaccine for a control program" or "Administer continuous oxytetracycline medication during the vector season" below). In addition, there are federal regulations pertaining to the interstate movement of known anaplasmosis carrier animals.

Test the herd and clear up the carriers with tetracycline antibiotics. Methods of carrying out this program are described in the section "Eliminating the Carrier State."

Administer anaplasmosis vaccine for a control program. For an effective vaccination program, the herd owner should follow these recommendations:

1. Administer the initial vaccination (first year) in the form of 2 doses given 4 weeks apart and scheduled so that the second dose is given at least 2 weeks before the vector season begins.
2. Administer a booster 2 weeks or more before the next vector season.
3. After the first booster, administer additional boosters at least every other year to provide adequate protection.

In herds where the percentage of anaplasmosis-infected animals is high, it may be economically practical to test all the animals in the herd and vaccinate only the test-negative cattle. Vaccination of anaplasmosis-infected cattle is unnecessary. A positive test reaction resulting from vaccination cannot be differentiated from the positive reaction caused by the natural infection.

Keep in mind that a vaccinated animal is still capable of becoming infected with *A. marginale* and subsequently can become a carrier. The vaccine does not prevent infection, but it aids in the prevention of clinical signs or in the reduction in the severity of clinical disease. Some researchers think that the protection achieved by vaccination is very isolate-specific—that is, vaccinated animals may exhibit protection against *A. marginale* that occurs in Oklahoma and Kansas but may not be protected against the form of the disease that occurs in the Southeast United States. It would be advisable to discuss this point with a local veterinarian before using the anaplasmosis vaccine.

Calf losses from cows previously vaccinated against anaplasmosis have been noted. The dam can be sensitized by blood elements in the vaccine if those elements are different from her own. The antibodies formed against the foreign blood elements are concentrated in the colostrum of the cow and passed to the newborn calf during postpartum nursing. If the calf has inherited the foreign blood type (from the sire), the calf could die within 1 to 5 days of age from the rapid destruction of its red blood cells by the colostral antibody. This condition in the calf is known as neonatal isoerythrolysis, NI, or the "yellow calf" syndrome. It can occur only when the dam is vaccinated. When using anaplasmosis vaccine as a control method, it is better to vaccinate the cows while they are open or as far from calving as possible. Vaccinating the herd sires will not produce the syndrome in calves.

Administer continuous oxytetracycline medication during the vector season. An injection of oxytetracycline is administered every 30 days, beginning with the start of the vector season and ending 1 to 2 months after the vector season ends. The recommended dose is 3 to 5 mg per pound of BW injected deep in the muscles of the rump. To ensure adequate absorption of the medication and to prevent excessive muscle inflammation, do not inject more than 10 ml per injection site.

Administer continuous chlortetracycline (CTC) medication during the vector season at a dosage of 0.5 mg CTC per pound of BW per day. For control of anaplasmosis, chlortetracycline may be administered by the following methods:

- Medicated feed (0.5 mg per pound of BW daily).
- Medicated salt/mineral mixes offered free choice, prepared to approximate daily consumption of 0.5 mg per pound of BW.
- Medicated feed blocks (consumption data should be available from the feed block or salt/mineral manufacturer).

In addition to the methods above, chlortetracycline can be administered at the rate of 1.0 mg per pound of BW every other day during the vector season. This is done by adding CTC to a milled ration or incorporating CTC into a range cube and then feeding the animals every other day.

Administer continuous chlortetracycline medication year-round. Chlortetracycline may be administered continuously throughout the year as medicated salt/mineral mixes with approximately 1,500 grams CTC per ton (35- to 50-percent NaCl).

Oral doses of chlortetracycline at 0.1 to 0.25 mg per pound of BW administered continuously through the vector season may prevent clinical anaplasmosis, but will allow carrier infections to develop or prolong the incubation period, so that clinical anaplasmosis may appear sometime after medication has been withdrawn. Therefore, it is best to administer CTC continuously year-round when using the drug at this low level.

It is essential that cattle receive an adequate uptake of the medicated mixes and blocks. This treatment requires placing the mix or blocks near water holes, providing sufficient protection from the sun and rain, and replenishing the mix at frequent intervals. Cattle often prefer natural salt licks over the medicated salt/mineral mixes. Therefore, check routinely to ensure that the cattle are consuming the medicated mix and adjust the palatability of the mix when necessary.

Bulls apparently do not consume adequate chlortetracycline and require additional protection, such as vaccination.

Treating And Halting An Outbreak Of Anaplasmosis

Until an anaplasmosis problem develops, producers usually are not concerned with control. Therefore, it is important that the produc-

er be familiar with the methods available for controlling an anaplasmosis outbreak.

Treating Sick Animals

Usually by the time a cattle producer sees clinical anaplasmosis, the animal is almost over the acute infection and is suffering from anemia. Any excitement or exertion could cause the animal to collapse, resulting in death. A veterinarian should be notified immediately to confirm the diagnosis and to treat the affected animal.

If treatment is initiated, it is recommended that a single treatment with LA-200 (200 mg per ml oxytetracycline) at the rate of 9 mg per pound of BW be administered, rather than repeated treatments with a lower concentration of oxytetracycline. Blood transfusions may be indicated and should be administered by and on the advice of a veterinarian.

The blood of an animal with clinical anaplasmosis is at least 20 times more infectious than a healthy carrier's blood. The best thing to do is to move the healthy animals away from the sick ones (exertion could kill the clinically ill animals) and provide adequate protection for the susceptible animals in the herd (newly exposed animals are still in the herd).

Protecting The Rest Of The Herd

In addition to treating the sick animals, one of the following methods should be used to provide protection for the remainder of the herd to halt the outbreak.

Use of injectable oxytetracycline. At the first indication of anaplasmosis, gather all animals older than 6 months of age and administer 3 to 5 mg oxytetracycline per pound of BW. This treatment must be repeated at 28-day intervals throughout the vector season. After withdrawal of the medication, close observation should continue for symptoms of anaplasmosis that may have been only delayed, not stopped, in some cattle.

Use of vaccine and oxytetracycline together. At the first indication of anaplasmosis, gather all animals over 6 months of age and give

Antibiotic Treatment Regimens For Anaplasmosis Management.

Use & Drug	Route	Dose (mg/lb. BW)	Frequency of Treatment
Prevention			
Chlortetracycline	Oral	0.10-0.25	Daily Year-Round
Chlortetracycline	Oral	0.5	Daily During Vector Season
Oxytetracycline (50-100 mg/ml)	IV or IM	3-5	Every 28 days During Vector Season
Oxytetracycline (LA-200)	IM	9	Every 28 days During Vector Season
Carrier Elimination			
Chlortetracycline	Oral	0.50	Daily for 120 days
Chlortetracycline	Oral	5.0	Daily for 60 days
Oxytetracycline (50-100 mg/ml)	IV or IM	5.0	Daily for 10 days
Oxytetracycline (50-100 mg/ml)	IV or IM	10.0	Daily for 5 days
Oxytetracycline (LA-200)	IM	9.0	4 RX at 3 day intervals
Treatment Of Sick Animals			
Oxytetracycline (50-100 mg/ml)	IM	5.0	Usually one treatment
Oxytetracycline (LA-200)	IM	9.0	One treatment
Temporary Protection During Outbreaks			
Oxytetracycline (50-100 mg/ml)	IM	5.0	One treatment
Oxytetracycline (LA-200)	IM	9.0	One treatment
Prolonged Protection During Outbreaks			
Oxytetracycline (50-100 mg/ml)	IM	5.0	Every 28 Days During Vector Season
Oxytetracycline (LA-200)	IM	9.0	Every 28 Days During Vector Season
Chlortetracycline	Oral	0.50	Daily for 60 days

Note: Vaccine is used to stimulate prolonged resistance; however, until the resistance is established, OTC injections should be used simultaneously with each dose of vaccine to temporarily reduce the *A. marginale* challenge.

Key: IV = intravenous; IM = intramuscular.

each animal the first dose of Anaplaz vaccine and 3 to 5 mg oxytetracycline per pound of BW. Four weeks later, give the second dose of Anaplaz vaccine and another dose of oxytetracycline.

If anaplasmosis occurs because an Anaplaz booster injection was skipped, administer a booster vaccination and 3 to 5 mg oxytetracycline per pound of BW to all previously vaccinated animals, followed by a second dose of each repeated in 4 weeks for the previously non-vaccinated animals in the herd.

Use of injectable oxytetracycline and oral chlortetracycline. At the first indication of anaplasmosis, gather all animals over 6 months of age and administer a single dose of oxytetracycline at rate of 3 to 5 mg per pound of BW and immediately offer chlortetracycline free-choice in a medicated salt/mineral mix or feed block (0.5 mg per pound of BW). Offer chlortetracycline-medicated mixes or blocks for at least 60 days. Make regular checks for at least 60 days to ensure adequate consumption of the medicated mixes or feed blocks.

Antibiotic treatment regimens for anaplasmosis control, elimination of the carrier stage, and handling outbreaks are summarized in the table on page 6.

Helpful Hints For Using Chlortetracycline In Salt/Mineral Mixes For Range Cattle

When chlortetracycline (CTC) is mixed in a free-choice formula, it is important that no other source of the nutrient be available to the cattle. For example, when a salt mix is used as a vehicle for the CTC, no other source of salt should be available. If a calcium/phosphorous/mineral mix is used as a vehicle for the CTC, then no other source of these minerals should be available. Under these circumstances, the medicated supplement must provide the daily required supplemental amounts of the nutrients.

When formulations have been designed to provide only salt at the required nutritional level for range cattle, all other required nutrients must be supplied from the pasture or other supplements.

Feeding Free-Choice Supplements

- The range mix should provide the only source of supplemental salt available.
- Place the medicated supplement in several areas where cattle will congregate in the pasture (for shade, water, etc.).
- Begin feeding the medicated supplements by putting out only a 2- or 3-day supply in the pasture. This will allow you to accurately measure consumption and make proper adjustments to achieve the desired medication intake. Adjustments to either encourage or discourage the consumption of the medicated supplement can be made by changing the formulation of the supplement or by changing management practices.
- When the correct consumption rate has been achieved, then place a 1-week supply of the medicated supplement in the feeders. To ensure the potency of the medication, lace no more than 1 week's supply of the supplement in the feeders.
- When using chlortetracycline (CTC) as an aid in the control of anaplasmosis, feeding supplements containing CTC should begin before and continue through the vector season.

Increasing Consumption of Medicated Supplements

- Increase the level of palatable ingredients (CSM, SBM, or dried molasses) as the level of the salt is decreased.
- Feed the medicated supplement in feeders which also contain the calcium/phosphorous supplement.
- Place the feeding stations throughout the pastures at the locations where the cattle normally gather (shade, water, etc.)

Reducing Consumption of Medicated Supplements

- Increase the salt level at the expense of more palatable ingredients.
- Reduce the number of feeding locations.

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