Ovine infectious abortion
Larry D. Holler
Animal Disease Research and Diagnostic Laboratory, South Dakota State University, Brookings, SD

Infectious abortion in sheep flocks is a serious, widespread disease problem in North America. It is important for sheep producers and their veterinarians to understand the circumstances under which abortion diseases occur, so that effective preventive health and management programs can be implemented to minimize economic loss from these diseases. The following outline should provide you with sufficient information about the abortion diseases to help you formulate a disease control/prevention plan that should work for the majority of operations that you work for. Also keep in mind that a 0% abortion rate is probably not an obtainable goal.

Campylobacteriosis (Vibriosis)

Introduction
Campylobacteriosis (Vibriosis) is an acute contagious disease of pregnant ewes. The disease causes extensive financial loss to the sheep industry.

Etiology and pathogenesis
Campylobacteriosis is caused by the bacteria *Campylobacter fetus* ss. *fetus* and *Campylobacter jejuni*. Transmission involves ingestion of the bacteria from feces or fluids from aborting ewes, and uterine localization with subsequent abortion is an accidental outcome of a brief period of bacteremia (bacteria in the blood stream) in non-immune sheep. *Campylobacter jejuni* is a common inhabitant of the intestinal tract of normal cattle, dogs, cats, and rodents although significance of each of these reservoirs is unknown. Campylobacter may be spread from infected farms to non-infected farms by purchase of carrier sheep, birds and other animals, particularly coyotes and dogs. Stress from other abortive agents, weather, nutrition and overcrowding can trigger *Campylobacter* abortions.

Clinical signs
*Campylobacter* causes abortion during the last trimester of pregnancy or birth of dead or weak lambs. Most aborting ewes recover but some die from retention of dead lambs, infection of the uterus, and peritonitis. Abortion rates vary from 5% to 70% in a natural outbreak.

Diagnosis
Abortions resulting from *Campylobacter* are usually visually indistinguishable from other causes of abortion. Consequently, laboratory diagnosis is necessary. Aborted fetuses and placentas should be submitted to a diagnostic laboratory. Concurrent infections with other agents such as Toxoplasmosis are possible.

Treatment and prevention
Rapid diagnosis is critical. The predominant *Campylobacter* sp. isolated in the upper Midwest is *C. jejuni*. Essentially all of these isolates appear to be resistant to tetracycline in vitro and in vivo. Once an outbreak of *Campylobacter* occurs in the flock, I would still recommend starting antibiotic therapy until the sensitivity results are known. In years previous, and to some extent today, some people will recommend vaccination in the face of an outbreak. Immunity to *Campylobacter* is strain specific and there are probably numerous strains circulating in a large population of sheep. Within an open flock, adding new sheep may mean adding a new strain. Prevention of *Campylobacter* sp. by vaccination of ewes at breeding may help, but remember, protection from one stain to another is limited. Autogenous vaccines are becoming more common in large flocks. Avoid feeding ewes on the ground. During an outbreak, spread of the disease can be minimized by burning or burying all aborted fetuses and placental membranes. In addition, aborting ewes should be isolated until all uterine discharge has ceased.
Zoonotic risks

*Campylobacter jejuni* is one of the leading causes of human food poisoning. Clinical signs include a severe diarrhea. *Campylobacter jejuni* is transmissible from infected ewes, aborted fetuses, and placental membranes to humans.

**Toxoplasmosis**

**Introduction**

Toxoplasmosis is an infectious disease that occurs sporadically, usually in farm flocks, causes considerable economic loss to the sheep industry.

**Etiology and pathogenesis**

Toxoplasmosis is caused by a coccidial organism (*Toxoplasma gondii*) that is carried by domestic cats. Young cats excrete the organism in the feces. Transmission of the infection from cats to sheep occurs when the sheep feed becomes contaminated with feces from infected cats. Ingestion of the contaminated feed causes infection in sheep.

**Clinical signs**

Ewes infected with *T. gondii* are asymptomatic. In a rare case, a ewe may show signs of encephalitis, including walking in circles, uncoordinated movements, muscular rigidity, prostration and impaired vision. Ewes with uterine toxoplasmosis may abort during the last month of pregnancy or give birth to dead or weak lambs. The weak lambs are listless, uncoordinated and usually die from starvation. Abortion usually occurs about four weeks after infection in experimental cases. Mummified fetuses are often a feature of toxoplasma infection during gestation.

**Diagnosis**

Toxoplasmosis is diagnosed by laboratory examination of fetal blood and thoracic fluid by indirect fluorescent antibody procedures for detection of antibody to *T. gondii*. Fetal tissues and placenta from aborting ewes are examined for characteristic gross and histologic lesions. Occasionally, serologic screening of the ewe flock may be necessary to make this diagnosis in an endemic flock.

**Treatment and prevention**

There are limited data that feeding monensin (Rumensin®) and decquinate (Deccox®) will reduce the severity of placental infection associated with toxoplasmosis in pregnant ewes. The medication must realistically be fed throughout gestation. Experimentally, lasalocid (Bovatec®) has been shown to have no effect on *T. gondii*. Limiting cat populations and avoiding contamination of sheep feed and water with cat feces provides satisfactory control of the disease. Shedding of this organism is most common in young cats or cats with litters. Mature cats that have been spayed or neutered present limited risks for transmission of infective oocysts. Currently there is a modified live vaccine in use in England, although no products are approved for use in the United States.

**Zoonotic risks**

Toxoplasmosis is a significant zoonotic risk for humans. Pregnant women are at particular risk since toxoplasmosis causes encephalitis in the fetus. Humans usually contract this disease from exposure to feces from infected cats shedding oocysts.
Enzootic abortion of ewes; Chlamydiosis

Introduction
Enzootic abortion of ewes (EAE) is a highly contagious zoonotic disease that causes severe economic loss to the sheep industry in many geographic areas.

Etiology and pathogenesis
Enzootic abortion of ewes is caused by an intracellular (lives most of its life cycle inside the cell) microscopic organism, called *Chlamydia abortus* (old name *Chlamydia psittaci*). The transmission of EAE from infected sheep to susceptible sheep occurs at the time of parturition and abortion. Some data suggest that possible transmission may occur through a fecal oral route or oral contact with uterine fluids in cycling ewe lambs. The aborted fetus, placenta, and uterine fluids contain large numbers of infective organisms allowing for rapid transmission of the disease. Transmission also probably occurs to some degree through feed or water contaminated by aborting ewes and subsequently ingested by susceptible ewes. Crowding in lambing facilities may also cause spread of EAE through the respiratory tract.

Clinical signs
Infection is most often asymptomatic. Infection of ewes between 30 to 120 days of lambing usually results in abortion or birth of weak lambs, while infection during the last month of pregnancy may result in latent infection and possibly abortion during the next pregnancy. Ewes may die as a result of secondary bacterial infection of the uterus (retained placentas etc.).

Diagnosis
It is important to obtain laboratory confirmation if EAE is suspected. The aborted fetus and the placenta are required for laboratory examination. A laboratory diagnosis is sometimes difficult and may require submission of several aborted fetuses with placentas if the sample quality is poor. Diagnosis without submission of placenta is usually unrewarding.

Treatment and prevention
Outbreaks of EAE are treated with tetracycline antibiotics in the feed at the rate of 500 mg to 700 mg per head daily. Treatment with long-acting tetracycline may extend the duration of a threatened pregnancy. The net result of tetracycline treatment is suppression chlamydial multiplication. Antibiotic therapy will not reverse the damage to the placenta that is already done. Antibiotic therapy as a routine procedure should be evaluated in light of the situation in each individual flock. Prevention of EAE has been attempted for many years through vaccination. Currently available products are probably minimally effective. Routine administration of feed grade tetracycline during the last trimester of gestation (five days on, two weeks off) has significantly reduced the incidence of *Chlamydia abortus* in the upper Midwest. Pregnant ewes should not be fed on the ground, thus preventing feed contamination by aborting ewes. Aborting ewes and weak lambs should be kept isolated from other ewes and lambs until all uterine discharges cease and surviving lambs are normal. Aborted fetuses, weak lambs that have died and placentas should be burned or buried. Infected premises should be cleaned and disinfected as circumstances allow.

Zoonotic risks
*Chlamydia abortus* is a potentially serious threat to pregnant women and any individual that is immunosuppressed (cancer therapy, steroids, HIV, etc.). Hepatitis and severe flu-like symptoms have been reported. Abortion in pregnant women is a real threat.
**Salmonellosis**

**Introduction**

Salmonellosis is an acute contagious disease. Outbreaks of the disease occur sporadically and can result in severe economic loss.

**Etiology and pathogenesis**

Salmonellosis is caused by several species of *Salmonella* bacteria. *Salmonella* are harbored by adult carrier ewes that shed the bacteria into the environment through the feces. Ewes develop resistance with age or as a result of exposure to the bacteria. First lambing ewes, having little or no resistance to the bacteria, are susceptible to the infection. Disease occurs as a result of non-immune ewes ingesting *Salmonella* through contaminated feed or water. Infected cattle (particularly calves) can be a source of *Salmonella* infection for sheep.

**Clinical signs**

Affected ewes usually develop high fever and severe diarrhea, are depressed and off-feed, abort and may die. Others may show minimal clinical signs. Ewes that survive have much less milk for their lambs. Lambs that are born alive from infected ewes are usually weak and may die.

**Diagnosis**

Diagnosis of salmonellosis is accomplished by bacterial culture from tissue collected from aborted fetuses and tissues from the affected ewe.

**Treatment and prevention**

Several antibiotics have been used to treat salmonellosis with generally poor results. Aggressive antibiotic therapy may be required to limit death loss in the ewe flock. Prevention of the disease is related primarily to management since vaccines have limited use against salmonellosis.

**Zoonotic risks**

*Salmonella* bacteria are very infective for humans. Extreme care should be exercised when handling infected tissues.

**Listeriosis (circling disease)**

**Introduction**

Listeriosis is an acute, infectious, but non-contagious disease that occurs sporadically in sheep flocks. The disease causes considerable economic loss in affected flocks.

**Etiology and pathogenesis**

Listeriosis is caused by the bacteria *Listeria monocytogenes*. The organism lives in the environment and most commonly causes disease through the feeding of improperly ensiled or spoiled silage or spoiled hay. Listeriosis usually occurs as encephalitis but may cause abortion.

**Clinical signs**

Ewes with the neurological form of listeriosis become depressed and disoriented. Affected sheep may walk in circles. A head tilt and facial paralysis on one side is commonly observed. The mortality rate of sheep affected is usually high. The uterine form of listeriosis causes abortion in late pregnancy. Most aborting ewes recover from the infection.
Diagnosis

Diagnosis of listeriosis is made on the basis history and clinical signs. Confirmation of the diagnosis is accomplished by laboratory isolation of the causative bacteria from the affected animals. Numerous bacteria are present in all tissues on histologic examination.

Treatment and prevention

There is no proven effective treatment for listeriosis. Prevention of the disease is accomplished by feeding good quality silage. When an outbreak of listeriosis occurs, discontinue feeding silage, isolate affected sheep. Properly dispose of sheep or fetuses that have died from listeriosis.

Zoonotic risks

Human cases of listeriosis have occurred from handling infectious tissues and from inhaling dust from dried bedding in contaminated lambing sheds.

Miscellaneous etiologies

Border disease virus, Cache Valley fever, Flexaspira rappani, Yersinia enterocoliticus, Bacillus sp. E. coli and several viruses are occasionally associated with abortion in sheep flocks. The significance is usually minimal.

Key management practices to prevent/control abortion diseases
1. Minimize stress and overcrowding during late gestation.
2. Maintain a closed flock.
3. Do not feed pregnant ewes on the ground (EAE, campylobacterosis, and salmonellosis).
4. Limit cat population and protect feed from cat fecal contamination (toxoplasmosis).
5. Keep first lambing ewes separate from mature ewes when confined at lambing (salmonellosis).
6. Isolate sick, infected (aborting) ewes to avoid transmission of disease (EAE, campylobacterosis, and salmonellosis).
7. Do not allow pregnant ewes to drink ground water in confinement which is subject to fecal contamination.
8. Dispose of aborted fetuses, placentas, and dead lambs by incineration or deep burial if possible.
9. Utilize the assistance of a competent sheep veterinarian and diagnostic laboratory to establish accurate diagnosis and effective plan of action when abortions begin.
10. Vaccination and antibiotic therapy are valuable management tools. They will not necessarily eliminate the problem. Each product should be evaluated for efficacy. Some products currently on the market are of limited value.

Sample submission for diagnostic evaluation of ovine abortion
1. Fresh chilled fetuses with placenta are the specimen of choice. Frozen lambs are of limited diagnostic value.
2. If a necropsy is performed at the farm or clinic, submission of the following tissues is recommended:
   a.) fresh and formalin fixed (10% buffered neutral formalin) tissues including lung, liver, kidney, spleen, heart, brain and PLACENTA.
   b.) fetal thoracic fluid or heart blood (for indirect FA’s for toxoplasmosis and Chlamydia)
   c.) fetal stomach content (bacterial culture)
3. Serum from the ewe is usually of little value early in an abortion workup. It may be a good idea to bank serum from affected ewes if the need arises at a later date.
4. An adequate history should include percent or number of ewes affected, breed, age of affected ewes, parity, nutritional status, previous disease conditions, vaccination history, antibiotic therapies and environmental conditions as they may apply to the existing problem.