



6. Diseases of Pregnancy

Abortion Storms

The situation is considered to be an abortion storm if:

- more than **five percent** of exposed females have aborted following one breeding season, or
- if abortions occur as a cluster in time during the lambing/kidding period, or
- if there are an increased number of stillbirths and/or weak lambs or kids.

Zoonosis Alert: Pregnant women should avoid handling pregnant ewes or does during the birthing and peri-parturient period (the time immediately following birthing) because many of the abortion diseases can infect humans and unborn babies.

To be able to accurately assess if this is happening you will need to know:

1. How many females were bred in any one breeding group.
2. From the exposure dates, when you can expect the first babies to arrive.
3. When each female gives birth, to how many, and if they live or not.
4. If the newborns die, when did they die and why.
5. The result of any laboratory submissions (if you do not look for disease you will never find it).
6. The performance of the flock last year and how this year compares.

Zoonosis
– a disease of animals that may secondarily be transmitted to man.

7. Were any new animals were introduced to the flock, and if so, the health status of the flocks they came from. To be able to decide if new introductions are a risk to your flock you first need to know the health status of your own flock. Sub-clinical levels of disease may be active in your flock but if its effect on flock health is not measured then you are unaware of its impact until the “storm” hits. It is not enough to say “I have not had a problem in the past” unless you have the records to back that statement up.

Vibriosis (*Campylobacter* Abortion)

Cause

Vibriosis is caused by the bacterium *Campylobacter fetus* and *Campylobacter jejuni*. These bacteria are normal inhabitants of the intestine in a wide variety of species, including sheep and goats.

The problem occurs when a group of animals that have never been exposed to the bacteria are suddenly infected. If sheep or goats are first infected in late pregnancy, it is likely that they will abort two to three weeks later.

Infection at any other time will simply result in development of a protective immunity in the dam.

Infected sheep or goats may continue to shed the bacteria in their feces for the rest of their lives.

Clinical Signs

Abortion usually occurs in late pregnancy. Abortion storms may be very severe, with up to 50 per cent of dams affected. There is often a history of new replacements being brought into the flock two to three weeks earlier, or a feed change in the same period. Once the disease is endemic in a flock, sheep/goats will become infected before they become pregnant and will develop immunity. However, replacement animals mixed with the flock in late pregnancy may abort.

Diagnosis

This requires laboratory analysis of aborted material. It is critical to any laboratory investigation of abortions to include the placenta from the affected dam. Do not freeze any of the aborted material, fetus or placenta, and always handle the infected products of conception with gloves.

Treatment

There is little one can do when faced with a campylobacter abortion storm; the infection has occurred several weeks previously. Herd treatment with oxytetracycline (either injectable or in feed) may be of some benefit.

Control

Controlling *Campylobacter* abortion in flocks is fraught with difficulty.

If the disease is completely excluded from the flock, the effects of introducing it can be disastrous. If the disease is endemic (already widespread in your flock) it is of no real significance. Sources of infection are replacement animals and wildlife. (Refer to *Chapter 22, Biosecurity*.) The disease is transmitted fecal-orally so that attention to keeping feed and water sources free of fecal contamination may be important in the control program for this disease.

Vaccination

A vaccine is available for sheep in Canada. You should discuss the potential for its use with your flock veterinarian. The vaccine is a killed product; subsequently, vaccination protocols must be designed to ensure maximum immune response to the product. If the vaccine is not going to be used according to the directions then there is no point in using it at all.

Zoonosis Alert: Infection in sheep and goats may be associated with diarrhea and the bacteria may also cause diarrhea in humans.

Toxoplasmosis

Cause

This disease is caused by the protozoal parasite *Toxoplasma gondii*. The parasite has a complex life cycle. The eggs are passed in cat feces and can be ingested by sheep or goats. The parasite then forms microscopic cysts in various tissues in the animal. There is no effect of infection unless a pregnant female is infected for the first time while pregnant; she may subsequently abort the fetus.

The fetal membranes of the aborted fetus will contain toxoplasma cysts which are also infectious to other animals. This can result in an abortion storm. Depending on the immune status of the flock and the level of infection, up to one-quarter of ewes/does may be affected.

Clinical Signs

The clinical signs associated with the infection will depend on the stage of pregnancy at which infection occurs.

In the **first two months** the fetus will be killed with no outward signs; the dam will re-cycle and may or may not conceive. This will simply look as if the dam was infertile, and the lambing/kidding interval will be extended.

In **mid-pregnancy** the fetus will die and likely become mummified, or the fetus may survive to be born prematurely and weak, unlikely to survive.

Infection in **late** pregnancy has little effect.

Diagnosis

In some cases, there may be small white spots on the cotyledons (buttons) of the placenta. Otherwise, diagnosis requires laboratory confirmation.

Treatment

Fortunately, toxoplasmosis appears to be a rare cause of abortion in western Canada, either because it truly is not there or it has not been looked for during laboratory diagnostics.

There is some evidence that when you are faced with a toxoplasmosis abortion outbreak, medicating feed with monensin (Rumensin) may be beneficial. Because this product is not licensed for use in sheep/goats, you will require a veterinarian to write the prescription.

Considerations for Management Team

Complete control of cats on farms is not really practical. However, attempts should be made to control the number of young cats as they excrete the most *Toxoplasma* oocysts (eggs).

Every attempt should also be made to keep the cats out of all forms of feed; do not let the cats use the chop house as a cat box.

If breeding females are continually exposed to cats it is likely that they will be infected when not pregnant and be able to develop a protective immunity before pregnancy.

Zoonosis Alert: *Toxoplasma* can infect humans. Immuno-compromised individuals and pregnant women are especially susceptible to toxoplasmosis infection, with serious consequences. Such individuals should avoid contact with cat feces and never have contact with aborting sheep.

Chlamydial Abortion (Enzootic Abortion of Ewes, EAE)

Cause

The cause of this disease is *Chlamydophila abortus* (previously known as *Chlamydia psittaci*). This is the most commonly diagnosed form of abortion in sheep and goats; it is also the most difficult to control because of the organism's complex life cycle.

If a ewe/doe is infected with EAE in late pregnancy there will be no effect during that pregnancy. However, she will likely abort at the end of the following pregnancy. This can cause significant problems when you come to purchase new stock. A ewe/doe may be bought with no history of abortion, yet she may be carrying chlamydia. She will abort her next pregnancy and contaminate the rest of flock, leading to a serious abortion storm the following year.

Abortion commonly occurs in the last two weeks of pregnancy. The fetus looks normal or lambs/kids may be born prematurely and be very weak.

In some cases the region of the placenta between the cotyledons (buttons) can appear yellowed and thickened.

Abortion rates may reach from one-third to one-half of the flock.

A ewe/doe aborting from chlamydia will shed the organisms in the fetus, placenta and all vaginal discharges for up to one month. Other animals that lick contaminated areas will develop an infection. An-

other way to spread this disease is to pile old bedding from the lambing barn in a place where other females will be exposed to it and come in contact with the microorganism.

After an abortion the animal develops a strong immunity that should last at least three years.

Diagnosis

This requires laboratory analysis of the aborted placenta and fetus.

Treatment

Chlamydophila abortus is susceptible to oxytetracycline antibiotics. It may be possible to treat the herd with a long acting product or use a medicated feed before the birthing period begins. Consult with your veterinarian.

Considerations for Management Team

Real care must be taken when purchasing replacement ewes/does. If the abortion history of the seller's flock is not known, purchase with extreme care.

Consider housing such animals separately from the rest of the flock.

Vaccines are available to help manage this disease. The first dose is given two months prior to breeding and the second dose one month prior to breeding. Annual vaccination at one month prior to breeding is also required. If you consider your flock to be at risk you should discuss vaccination with your veterinarian.

Zoonosis Alert: *Chlamydophila abortus* can be transmitted to humans and can cause abortion in pregnant women.

Other Causes of Abortions

There are many potential causes of abortion. The following diseases are uncommon but are identified occasionally:

- Salmonellosis
- Border disease
- Q fever
- Listeriosis
- Brucellosis

Salmonellosis

Cause

Various strains of *Salmonella* have been linked to abortion outbreaks in sheep and goats. *Salmonella* is usually thought of as a cause of serious diarrhea. However, in late pregnancy if the dam is sick enough she will abort. One particular strain of *Salmonella*, *S. abortus ovis*, can cause very serious problems, although other strains are also capable of causing clinical disease.

The source of the infection is rarely known. It may be from contaminated feed, water, wildlife, new introductions, or exposure to sewage material. Once in the flock, feces and abortive products from affected animals will spread the disease.

Diagnosis

This requires laboratory analysis.

Treatment

Once the bacteria have been identified in an outbreak situation, and the susceptibility to antibiotics determined, it may be possible to use an antibiotic to minimize the effects of the disease.

Control

The control of this disease is similar to *Campylobacter* infection:

- Attempt to keep wildlife away from sheep/goat feed.
- Control rodents.
- Ensure water sources are unpolluted.
- Take care when purchasing replacement animals.

Considerations for Management Team

Salmonellosis is a management disease. Attention to hygiene is critical to controlling *Salmonella* associated disease in all species. In the long term, treatment plans that do not include an assessment of the environmental risks and a way to manage them will fail to control the disease.

Border Disease

Cause

This disease is caused by border disease virus. This virus can circulate in sheep (goats appear to be resistant) and cause almost no problems. However, if dams are infected while pregnant, there may be different outcomes depending on the stage of pregnancy.

Clinical Signs

Infection during the first half of pregnancy usually causes fetal death. This may cause immediate abortion. In other cases, ewes may abort some time later, even close to term.

If the fetus survives infection, it is usually born with birth defects. The most common type of defect is termed a “hairy shaker.” These lambs tremble continuously due to nerve damage from the virus; they also typically have an unusual “hairy” fleece because the virus has damaged the fibre follicles

Some newborns may have eye abnormalities or other defects.

Diagnosis

Laboratory analysis is required.

Treatment

There is no treatment for this viral disease. Affected lambs should be humanely euthanized because they continuously shed virus and are a source of infection for the rest of the herd.

Refer to *Chapter 5, Hairy Shakers*.

Considerations for Management Team

Develop effective biosecurity measures to prevent bringing the disease onto the farm. When cattle and sheep are co-mingled the risk of a border disease outbreak is increased.

Q-Fever

Cause

Coxiella burnetii can cause abortion in a wide variety of species. The organism is very hardy and can survive in the environment for a long time. It is shed in the abortion fluids and lives in dust. Transmission is by ingestion or inhalation of infective dust. Remember, if you do not look for this organism, you will never be sure if it is causing abortion or stillbirths. *Coxiella* should always be part of the "abortion work-up" which includes *Campylobacter*, *Chlamydia*, and *Coxiella*.

Clinical Signs

Abortion and stillbirth in late pregnancy. The dams may occasionally show signs of mild illness such as reduced appetite.

Diagnosis

Laboratory examination of the fetus and placenta is required.

Treatment

Use tetracycline medications as injections or feed additives, as described previously.

Prevention

No vaccine is available.

Zoonosis Alert: *Coxiella* can cause very serious heart disease in humans. Extreme care must be exercised by the management team if *Coxiella sp.* is identified circulating in the flock.

Listeriosis

Cause

This disease is caused by the bacterium *Listeria monocytogenes*. Although it is most commonly associated with "circling disease" it can cause abortion during pregnancy. Listeriosis has been closely associated with feeding silage to small ruminants. (Refer to *Chapter 10, Listeriosis*.)

Clinical Signs

Abortion, possibly with neurological signs typical of nervous listeriosis.

Diagnosis

Laboratory examination is required.

Treatment

Individually affected animals can be treated with oxytetracycline.

Considerations for Management Team

The source of the bacteria must be identified to control flock exposure. Ensure that any silage fed to small ruminants is high quality.

Brucellosis

Cause

In sheep *Brucella ovis* mainly causes an infection of the ram's testicles (orchitis) and occasional cause abortion in females. In goats *Brucella melitensis* causes abortion. In sheep the disease is passed from the ram to the ewe. In goats, the does that abort shed the organism in milk, urine, feces and from the vagina.

Clinical Signs

Most abortions from this infection occur early during pregnancy. Affected rams have abnormal testicular conformation and reduced fertility.

Diagnosis

Analysis of the aborted fetus and placenta is required.

Prevention

You should examine the testicles of all rams pre-breeding. Do not buy breeding animals from an unknown source. There is no vaccine available for use in any small ruminants. Affected rams can be identified during the pre-breeding soundness evaluation.

Zoonosis Alert: *Brucella melitensis* is considered an important human pathogen. As previously advised take care when handling abortions. Brucellosis is a reportable disease.

When you are faced with any abortion, try to save all of the products of abortion, fetus and placenta, for further laboratory examination. Any material that is not saved for laboratory submission should be burned or buried and kept away from dogs, cats, birds, and other sheep or goats. Remove all bedding contaminated by the birthing process and burn it. **Do not** fork it out into the corral to expose the remaining females. Isolate the dam who has aborted until a diagnosis is reached and/or the uterine discharges have stopped. Be **very** careful to protect the management team that is caring for the affected individuals from becoming infected.

Zoonosis
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Metabolic Diseases Associated with Pregnancy

Pregnancy Toxemia (Twin Lamb Disease)

Cause

This condition typically occurs during the last third of pregnancy. It is most common in dams carrying more than one lamb/kid and is especially common in dams that are in either very fat or very thin body condition. The disease occurs due to the metabolic demands of the offspring outstripping the mother's energy supplies. As well, as the lambs/kids grow in the uterus they compress the stomach, reducing the mother's capacity to consume greater volumes of feed. In the case of a thin ewe/doe there are no body reserves to make up the energy deficit and she becomes sick. In a fat animal, the fat reserves mobilize rapidly and can swamp the liver's ability to deal with them. The end result for the fat female is the same as that for the thin animal.

Note: Pregnancy toxemia may be complicated by hypocalcemia and polioencephalomalacia. Refer to *Hypocalcemia* in this chapter. Refer to *Chapter 10, Polioencephalomalacia*.

Clinical Signs

An affected animal become depressed, goes off feed, eventually lies down and is unable to stand. As the disease progresses she starts to tremble and grind her teeth, and may gaze up at the sky.

Diagnosis

The best way to confirm the diagnosis is to test the urine for ketones. You can get dip sticks from your veterinarian which will change color if ketones are present in the urine. To get a urine sample from a ewe/doe, simply cover her mouth and nostrils so she cannot breathe. After about 30 seconds she will urinate in response to the slight stress.

Treatment

It is vital to treat pregnancy toxemia quickly and aggressively. The longer you wait the less chance there will be for treatment to be successful. The challenge is that until the pregnancy ends it is very difficult to treat the dam. You should discuss a treatment plan for pregnancy toxemia with your veterinarian **before** you even start breeding.

Treatment options include:

1. Emergency C-section to remove the lambs/kids. The goal here is to save the dam as the prognosis for the lambs'/kids' survival is poor.
2. Terminate pregnancy with a dexamethasone injection. This is an economical option and supports the dam as well. Dexamethasone helps prepare the lambs/kids for birth, but the majority of offspring will go on to die.
3. Treat the mother conservatively. Give dextrose solution intravenously (100 to 250 mL of 50% dextrose). Be very careful not to inject the dextrose perivascular as this may cause the skin overlying the injection site to slough off. Give oral drenches with sugar and propylene glycol. Offer the mother highly palatable feed and encourage her to eat.

Prevention

Ensure ewes/does are in appropriate body condition during pregnancy. Ensure a good quality diet in late pregnancy is available. Slowly increase concentrates (grain) in the ration to provide additional energy and to compensate for a reduced capacity for feedstuffs.

Feed bunk management becomes critical in the late pregnancy stage. Ensure that all pregnant females have adequate access to feed. Ensure that the stocking density in the pens takes into account dominance issues within the group that could affect feed consumption. Avoid sudden changes in diet or management that may make animals go off feed. Going off feed can cause pregnancy toxemia. In short, anything that adversely affects energy intake in late pregnancy will predispose the female to pregnancy toxemia.

Hypocalcemia (Milk Fever)

Cause

Milk fever is usually seen in the last few weeks of pregnancy or immediately before birth. The demand for calcium increases as the late-pregnant female readies for the onset of milk production. Lactating females are at risk of developing hypocalcemia until they reach peak lactation at 30 to 45 days postpartum. Hypocalcemia can be caused by a number of management related scenarios:

1. Having an absolute deficiency of calcium in the diet. The ration fed to the late-pregnant female simply did not provide enough calcium for her own metabolism.
2. An imbalance between calcium and phosphorus that affects how the female utilizes the calcium.
3. A dietary protein deficiency that causes a low blood albumin level and adversely affects how the animal utilizes the calcium.
4. Feeding high calcium forages late in pregnancy will adversely affect the female's ability to activate the metabolic processes she needs to cope with lactation calcium demands.

Clinical Signs

Clinical signs may resemble polioencephalomalacia or pregnancy toxemia. It would be wise to consider all three diseases when presented with an affected individual. (Refer to *Chapter 6, Pregnancy Toxemia*.)

Diagnosis

Analyzing a blood sample (serum) for calcium, phosphorus, and albumin is the only way to achieve a definitive diagnosis.

Treatment

Confirming the diagnosis is crucial. Fatal levels of calcium may be reached in the animal if calcium is injected based on an incorrect guess about the initial blood level.

Affected animals should be treated with 23 percent calcium borogluconate solution (50 to 100 mL, either intravenously or subcutaneously). Great care should be taken with intravenous dosing. Have your veterinarian train you to do this safely. Poor technique associated with intravenous administration of calcium products is responsible for treatment failures, death of the patient, and complications associated with the injection site.

Calcium is needed for a number of vital functions including those in the nervous and cardiovascular systems and for general muscle function.

Prevention

The strategy to prevent milk fever varies according to your production systems. Prevention is the key to managing hypocalcemia.

- **Sheep and meat goats**—ensure that the diet in late pregnancy contains adequate available calcium. This is where having a good relationship with a nutritional consultant is invaluable.
- **Milking goats**—ensure the diet during the dry period is calcium restricted to allow the female's calcium mobilization pathways to be enabled. Dietary management of the dairy sheep or goat is critical to maximizing the individual's milking capacity. Retaining the services of a nutritional consultant helps promote successful lactation management.



7. Mastitis

Bacterial Mastitis

Cause

Mastitis is defined as an inflammation of the mammary gland, most commonly caused by bacteria, especially *Staphylococcus sp.* and *Pasturella sp.* In most cases the infection enters the mammary gland through the teat during lactation. Often the early disease is not identified as the ewe or doe may not be generally sick. However, an experienced stockperson may recognize that the offspring are suffering either from starvation or a failure to thrive because the dam's milk supply is inadequate. The disease progresses within the udder, destroying the milk producing tissues and resulting in a non-productive half, or the infection might become so severe that the dam dies.

Clinical Signs

The clinical signs of mastitis are variable, depending on the exact strain of bacteria involved. In mild cases the only signs may be a slight change in the milk. In severe cases the udder may become hardened, red and hot. In more extreme cases the ewe/doe may become systemically sick due to the absorption of toxins into the bloodstream from the udder. In the most severe cases the udder becomes swollen and blue in color. The udder is cool to the touch and will actually slough off (blue bag).

Chronic Mastitis—Some cases of mastitis are identified at the pre-breeding examination. Typically one half of the udder is larger than the other and feels hard and irregular. It is likely that this is the final stage of an infection that occurred during the previous lactation.

Such animals are unlikely to produce milk from that half during subsequent lactations and should be culled. In some cases the infection within the mammary gland is confined to a single mammary unit, causing a lump to be formed after the infection has resolved. Individuals affected in this manner need to be closely monitored early in the lactation phase for an acute episode of mastitis.

Treatment

If the disease is identified early the antibiotics penicillin and oxytetracycline (at labelled dose) are both good choices. Newborns should be examined regularly to ensure they are receiving sufficient milk.

Note: Animals with blue bag should be humanely euthanized.

Diagnosis

Collect a clean milk sample before any antibiotic treatment is initiated; this is essential to help identify the specific bacteria causing the disease. Send the sample to a laboratory for culture and sensitivity testing.

The California Mastitis Kit may be used to help determine if there is inflammation present in the mammary gland; however, it will not tell you what is causing the disease. (This kit can be ordered through your veterinarian.)

Prevention

Most mastitis enters the udder through the teat end. The bacteria come either from the environment or the lamb/kid. Birthing areas should be kept as clean and dry as possible. You do not want a dam to lie in an area covered in large numbers of potentially infectious bacteria. Use plenty of clean bedding. Remove this bedding after birth and consider using a drying agent such as slaked lime before laying down new bedding. The area should be well drained; avoid overstocking. In areas prone to soiling, for example, individual mothering pens, the complete removal of bedding between animals is essential to mastitis and navel ill prevention.

Orf on the teat end may predispose to mastitis.

Orphans in the flock learn to move from dam to dam, grabbing the odd mouthful of milk. These lambs/kids can quickly spread orf or mastitis bacteria. They should be removed from the flock and reared by hand.

Considerations for the Management Team

Most shepherds will check the udder of a newly lambed/kidded dam to ensure that she has sufficient colostrum. Unfortunately, most do not think about the risks associated with such a procedure. A shepherd's hands are rarely clean and he or she may have just examined a dam with mastitis. Before stripping the udder of a ewe/doe, either wash and dry your hands or wear disposable latex gloves.

Hard Bag

Occasionally animals may be found at lambing/kidding time with a large udder that appears normal but is hard when palpated and produces little or no milk. It is not hot, red, or painful. This is an unusual form of maedi-visna in sheep or CAE in goats. (Refer to *Chapter 12, Maedi-Visna*.) These animals should be culled.

Mastitis in Milking Goats

Mastitis in milking goats is obviously a very important disease, both economically and with respect to human health. It is a complex disease, made complicated because of the spread of the disease occurs during milking. Any discussion of mastitis control in the milking herd is beyond the scope of this manual. There is limited information regarding mastitis in dairy goats; most of what is known has been extrapolated from cattle information. An excellent resource is *Mastitis Control in Dairy Herds* by R. Blowey and P. Edmondson – Old Pond Publishing. Producers are encouraged to contact their own veterinarian for further advice.

Note: Milking goats may be treated with intra-mammary preparations. This is an extra-label use and you should always consult your veterinarian regarding appropriate withdrawal times and technique.

Abnormal Lactation in Goats

Abnormal Lactation in Male Goats

Cause

An udder may develop in males, and produce milk, in certain lines of high producing dairy goats (gynocomastia). In some cases, these animals may develop mastitis. Fertility of affected males is otherwise normal.

Clinical Signs

The obvious sign is mammary development. If mastitis develops the gland will become swollen, red and painful.

ELDU

Extra-label drug use, also referred to as "off-label use" refers to the actual use or intended use of any drug, whether it is a prescription drug or over-the-counter (OTC) drug, in an animal in a manner that is not in accordance with the approved label or the package insert of the drug licensed by Health Canada.

Treatment

Never milk these animals. Reduce protein and energy in the diet to dry them up. If mastitis does develop, treat it according to established protocols.

Prevention

Bucks prone to the problem should be fed a restricted diet during high risk times of the year (spring and summer). In severe cases the udder can be removed surgically.

Abnormal Lactation in Female Goats

Cause

It is not uncommon in some lines of high producing dairy goats to see the udder develop at inappropriate times, even to the point of lactation.

Two common times are:

- 1.** Immediately after birth in newborn females; this is referred to as "*witch's milk*."
- 2.** At puberty, when it is referred to as "*maiden's milk*."

In some cases mastitis may develop.

Clinical Signs

Udder enlargement; some animals may also have dripping milk.

Treatment

Attempt to dry the animal off by restricting feed, and treat mastitis as appropriate. Do not milk these animals.