ABORTION AND FETAL WASTAGE IN GOATS AND SHEEP

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INTRODUCTION

Abortion outbreaks in goat herds and sheep flocks can lead to catastrophic loss of herd milk production, decreased lamb/kid crop, lost replacement or marketable stock, and cause significant risk of human disease. Many goat and sheep abortions occur in the last 6 weeks of gestation and during the dry period, resulting in lost lactation in addition to lost offspring. Successful diagnosis of the cause abortion in small ruminant herds/flocks requires submission of multiple abortion cases (fetuses, placentas, dam sera) to define the major contributing causes of abortion, as more than one agent or factor is often involved in the same outbreak. Management of abortion involves implementing steps to reduce within transmission of contagious pathogens within and among flocks/herds as well as implementing a plan to reduce human exposure to zoonotic agents of abortion.

NON-INFECTIOUS CAUSES OF ABORTION

The doe (in contrast to the ewe) is dependent on the corpus luteum throughout pregnancy, so any event such as prostaglandin administration (iatrogenic), endotoxemia, severe stress or other cause of luteolysis will result in abortion. Exposure to toxic plants less commonly results in teratogenesis and abortion. Angora abortion syndrome, congenital goiter of Boer goats, micronutrient deficiencies and extreme protein or energy deficiency can result in abortion, but most diagnosed causes of abortion in goats and sheep are the result of fetal infection. In the ewe, embryonic loss from prolonged exposure to heat under commercial range conditions is thought to be relatively common.

COMMON INFECTIOUS CAUSES OF ABORTION

Most contagious causes of abortion are spread most efficiently through direct exposure to placenta, birth fluids and lochia from aborting does and ewes. Fetal infection with most of these agents results in the abortion of fetuses in the last six weeks of gestation and often results in spread quickly throughout the herd/flock during the initial flock/herd exposure. Long term strategies are needed to reduce level of herd/flock exposure and increase herd immunity. Many of small ruminant abortion agents have zoonotic potential, and immediate action should be taken to minimize risk of human infection if an infectious abortion is suspected.

*Chlamyphila abortus* (Chlamydial abortion) is the one of most common causes of contagious abortion. Long incubation period results in late term abortion, and animals exposed in late gestation but not aborting may abort in subsequent gestation. Vaccination before breeding is recommended control the disease by reducing the number of aborting ewes/does and by maximizing herd immunity. The vaccine is approved for sheep only, but has been used successfully in both species. Vaccination in the face of an outbreak will not prevent abortions. Zoonotic potential is of concern.

*Coxiella burnetti* (Coxiellosis; agent of human Q fever) results most commonly in late term abortions, and may be diagnosed concurrently with other abortion agents. Apparently normal does and ewes may shed agent at parturition, resulting in potential for human exposure. The agent persists in the environment; aerosolized material from contaminated bedding have strong potential for human exposure (inhalation is the most efficient route of transmission in man). This agent has high zoonotic potential, especially by aerosol route.

*Toxoplasma gondii* (Toxoplasmosis) is introduced by the ingestion of oocysts from cat feces, but products of abortion serve as a source infectious organisms for other gestating females. Feed and bedding are often the sources of infection. Toxoplasma infection may result in early embryonic death, fetal mummification or abortion. Control of cat populations is key to managing toxoplasmosis on farms. Implementing a spay/neuter program on farms will allow the farm to maintain a population of mature low risk cats. There is high zoonotic potential for human fetal infection, especially for pregnant women handling the products of sheep/goat pregnancy-abortion.
Campylobacter abortions ("Vibriosis") are more common in sheep than in goats, but may occur in goat herds/flocks with combined species exposure. Campylobacter jejuni and Campylobacter fetus subsp. fetus infections result in severe placentitis and may have gross fetal lesions of focal hepatic necrosis. Short incubation period justifies antibiotic therapy and vaccination in the face of an outbreak. Although most human infections are from sources other than small ruminant abortion, these agents have strong zoonotic potential.

Other infectious agents causing small ruminant abortion - Less frequent but routinely diagnosed infectious causes of abortion include Listeria monocytogenes, Leptospira interrogans and Mycoplasma spp. Brucella melitensis would be of concern to practitioners working with goat and sheep populations outside of the United States. Border Disease Virus is responsible for teratogenesis and abortion in sheep and more rarely in goats. Arthropod vectors are responsible for the transmission Bluetongue Virus, which causes abortion and teratogenesis in addition to clinical disease. Similarly, abortion and teratogenesis (fetal arthrogryposis) are attributable to Akabane Virus (exotic to U.S.), Cache Valley Virus and Schmallenberg virus (Europe), with the latter affecting cattle as well as small ruminants.

ROUTINE HERD MANAGEMENT STRATEGIES TO MINIMIZE RISK OF CONTAGIOUS ABORTION

Maintain does/ewes in optimal body condition and dietary management. Minimize ingestion of infective abortion material by avoiding feeding pregnant does/ewes on the ground. Group does/ewes with the most susceptible younger animals separated from older does/ewes if possible. Do not house aborted females with pregnant females. Isolate herd/flock introductions, and determine prior reproductive history before introduction. Avoid introducing new animals during pregnancy, as they may be introducing new abortion pathogens in the herd/flock or prove to be susceptible females in an infective environment. To prevent toxoplasmosis on farms with cat populations, maintain a healthy spayed/neutered cat population to reduce susceptible cats/kittens on the farm and discourage the intrusion of new reproducing feral cats on the farm. Monitor feed and bedding storage areas for the presence of cat feces.

Placental tissue and other products of pregnancy should be removed from the kidding/lambing area frequently and disposed of properly for both normal and abnormal kiddings/lambings. Placental materials and lochia may be sources of abortion-causing organism like Coxiella in apparently healthy does and ewes at normal parturition. In addition to direct sheep/goat contact with fetuses and placentas, other wild and domestic animals on the farm can disseminate fetal/placental material (e.g. dogs, birds, rodents)

Monitor placentas for evidence of placentitis for all kiddings/lambings for early detection of a problem. Confine periparturient does/ewes to a specific area to minimize potential contamination of housing areas with placentas, lochia and fetal fluids.

Implement preventive vaccine strategies (extralabel) and/or gestational antimicrobial treatments for known abortion agents as justified by diagnosis from routine herd/flock surveillance. Efficacy of these measures, in goats especially, may be unproven, so documentation and record keeping would be critical, and evaluating response to treatment would be important for future herd/flock decision making.

ABORTION STORM STRATEGY – OBTAIN A DEFINITIVE DIAGNOSIS

History of new herd/flock introductions, prior fetal death and abortion patterns in the herd/flock may lead to the source of infection and whether outbreak is propagating. Are aborting does/ewes clinically ill? Did signs precede or follow abortion? The numbers of animals and abortions, ages, stages of gestation, previous abortions and herd/flock vaccination history allows definition of abortion rates and suspected agents by stage of gestation and pattern of transmission. Prior ultrasound records allow detection of presumed abortions as well as observed abortion rates. Repeat breeders, hydrometras, abortions, stillbirth, weak kids/lambs and healthy but extremely light or thin kids/lambs at birth (from placentitis leading to placental insufficiency) may be different manifestations of the same problem.

Necropsy of fetus and placenta - Send fetuses and placentas intact to diagnostic laboratory according to instructions from the diagnostic laboratory. Be sure to follow recommendations for suitable containers, ice packs and shipping shipment methods. Placenta is not always available, but is critical to likelihood of achieving a diagnosis. If necropsy is performed in the field, record the gross findings of fetus and placenta. Lesions are often confined to the placenta, for example the fibrinous placentitis found in many contagious abortions or the
presence of focal mineralizing cotyledonary necrosis in toxplasmosis. Include intercodyledonary and codyledonary samples and impression smears. Vaginal swabs may be helpful if placenta is unavailable. Fetal serum or pleural fluid can be tested for the presence of antibodies to a variety of agents. Abomasal contents, collected by aseptic technique, can be submitted for culture. Fetal samples should include fresh and formalin fixed lung, liver, kidney & brain.

**Dam serology-** Acute and convalescent sera are used to distinguish new from preexisting infections. The interpretation of dam serology can be limited by the long time between fetal infection and abortion in the case of agents with longer incubation periods, so a rising titer may not be detected at the time of abortion. Conversely, a high maternal titer may indicate dam infection but does not necessarily confirm that agent as the cause of fetal death. Presence of a fetal titer is indicative of fetal infection.

**HERD/FLOCK MANAGEMENT OF GOAT/SHEEP ABORTIONS – WHAT TO DO BEFORE YOU HAVE A DIAGNOSIS**

While awaiting a diagnosis, one should assume that the cause of abortion is contagious and potentially zoonotic. Restrict farm and kidding/lambing area entry to essential people and animal movements. Advise the owners of zoonotic potential, and minimize exposure of pregnant or immunocompromised people to aborting and parturient animals on the farm. Implement biosecurity practices to minimize human exposure. N95 masks are recommended to prevent *Coxiella* exposure. Gloves should be worn to handle all products of pregnancy. Disposable obstetrical sleeves should be used for all assisted deliveries. If vaginal discharge is abnormal or kids/lambs are known to be nonviable, deliver the products of pregnancy directly into disposable bags to minimize environmental contamination.

**ABORTION STORM STRATEGY – REDUCE WITHIN AND BETWEEN FLOCK TRANSMISSION**

Segregate pregnant females from aborted females (If possible, leave aborted females on contaminated area and move pregnant females). Avoid exposure of aborting females to any other production groups. Remove the products of abortion immediately, and isolate the aborting animals for 3-4 weeks if possible. Clean and disinfect (if possible) the area where the abortion occurred and any potential fomites (boots, shovels, clothing, vehicles). Implement appropriate intervention strategies (vaccination, antimicrobials, etc.) once a definitive or strongly presumptive diagnosis has been determined. Veterinarians must be careful to avoid transmission of infectious abortion agents during lambing/kidding season to other flocks/herds via contaminated boots, vehicles and clothing, even when no abortions have been observed.

**ABORTION STORM STRATEGY – REDUCE RISK OF ZOONOTIC DISEASE**

Take zoonotic disease precautions as part of routine obstetrical practice. Wear disposable gloves and if inhalation is a concern, use an N95 facemask to prevent inhalation of pathogens. Double bag abortion products & dispose safely. Avoid cross contamination of laundry with clothing worn to handle aborting does. Supply producers with occupational health information for workers and family members when a zoonotic agent is suspected on a farm, and provide information develop and occupational health plan as part of routine herd/flock health planning. Local public health officials and web-based material can be helpful resources. Advise farm staff to seek medical attention for any illness potentially related to aborting animals, and to advise their physicians of potential exposure to zoonotic agents.

**SHORT TERM CONTROL IN AN ABORTION STORM**

Injectable or oral tetracyclines may reduce the rates of *Chlamyphila* or *Coxiella* abortion, but do not cure fetal infection. Note that no product is approved for use in goats or sheep for this purpose, and therapeutic use in the face of a herd/flock problem would need to be documented. Oral tetracyclines therapy reportedly should begin before 75-80 days gestation (250-500 mg tetracycline/hd/day) to be effective, however recent changes in US law regarding Veterinary Feed Directives (VFD) preclude dosing beyond labeled levels or indications; extralabel injectable tetracyclines remain an option. Ionophores have been reported to help control toxoplasmosis, but there are no approved products in goats or sheep for this indication. Vaccination in the face of an outbreak may be warranted in cases of campylobacter abortion, although the sheep products are not approved for use in goats. Intranasal IBR vaccine has been used to control caprine herpes virus abortions. Does with confirmed abortions from mycoplasma infections should be removed from the herd, as these does remain carrier animals.
LONG TERM CONTROL OF ABORTION

Aborted does and ewes are usually immune to further abortions due to *Chlamydia abortus*, *Toxoplasma gondii*, *Coxiella burnetii* and other contagious abortion agents for several years, so as herd immunity increases the overall abortion rate may decline regardless of intervention. Several years later, abortion rates may increase as herd immunity wanes. Chlamydial (Chlamydophila) vaccine (licensed for sheep) may confer partial immunity, resulting in decreased abortion rates and decreased new infections over time. Plan a comprehensive program for reliable replacement purchase from herds without endemic abortions. Implement ongoing surveillance to determine the contributing causes of fetal death and abortion in client herds.

CONCLUSION

Diagnosis of the cause of abortion is essential to developing a sound management plan to prevent transmission of infectious agents or to prevent exposure to noninfectious risk factors for abortion or teratogenesis. Fetus, placenta and dam sera, along with a complete flock/herd history and knowledge of flock/herd replacements, movement, nutrition and environment are needed for accurate diagnosis of all contributors to fetal loss in the herd/flock. Until a definitive diagnosis is known, assume that all small ruminant abortions have zoonotic potential and implement strategies to minimize exposure of aborting females and their products of pregnancy to high risk people and other susceptible animals both within and among other flocks/herds. Long term management to prevent losses associated with abortion focus on maintaining a known source of safe replacement females, minimizing exposure within flock to products of abortion and maximizing herd immunity through controlled exposure and vaccination for agents with approved vaccines.