Diagnosis of Sheep and Goat Abortions
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**Importance of abortion diagnoses:**
- Minimize loss of animals
- Identify infectious causes of abortion
- Prevent further contamination / spread of disease within a facility / flock
- Minimize zoonotic risk

**Successful diagnoses:**
- With complete sample submission: 53%
- Without appropriate samples (especially placenta): < 30%

**Approach to an abortion:**

*History collection:*
- Determine the abortion rate: < 2% is normal
- >= 5% or clusters of abortions within 2 weeks’ time is serious

- Dam history:
  - # of previous abortions
  - # of previous live births
  - Age of doe / ewe
  - Breeding technique (artificial insemination, natural cover, semen type)
  - Days of gestation at time of abortion

- Herd history:
  - # of abortions
  - Stage of gestation of abortions
  - Previous and current diseases, problems
  - Size of flock / herd
  - Ages of aborting does / ewes
  - Animal movement (new additions, travel)
  - Recent handling (immunization, shearing)
  - Feed sources, condition of feed / storage, recent feed changes
  - Vaccination / deworming history
  - Environmental factors (extreme temperatures, toxin exposure, stressors, predation)
  - Exposure to other species
Sample collection: 3 parts to all abortions = Dam + Placenta + Fetus

The dam

- **Physical exam**: Complete physical examination of the aborting ewe or doe is very important. Evaluation for current illness including fever, general physical condition (emaciation and obesity), and nature of vaginal discharge is important and can help to differentiate infectious abortion from metabolic or other non-infectious causes of abortion.

- **Placenta or uterine swabs**: Whole or partial placentas are optimal, but if placenta is not present, uterine / vaginal swabs taken within three days of abortion can substitute. Specimens are essential for bacterial culture and PCR for infectious organisms and should be acquired whenever possible (Menzies, P. I. 2010).

- **Acute and convalescent serum**: Acute (at the time of abortion) and convalescent (2-3 weeks post-abortion) serum titers to common abortifacients is an important indicator of current and past exposure of the dam. In many cases, fetal and placental lesions may be absent, yet maternal titers may reflect current bacteremia or viremia and may help to diagnose infectious abortion. Paired titers are often analyzed simultaneously to decrease laboratory error.

The placenta

- **Placenta**: The whole or partial placenta is the critical link between the maternal and fetal components of abortion. Many abortifacients will only have organisms and lesions within the placenta with fetal death simply a result of placental failure and hypoxia. Collection and examination of the entire or even partial placenta is very important regardless of environmental contamination or autolysis. Many infectious organisms can be cultured or identified by PCR and histological lesions persist despite autolysis. Gross examination can also help identify infectious and non-infectious causes of placental failure. Submission of the placenta fresh on ice is preferable. If the placenta is no longer available, culture and submission of a swab from the dam’s uterus / vagina within 3 days of abortion can substitute.

The fetus

- **Whole fresh fetus**: Gross and histological examination of the aborted fetus is essential for diagnosis of infectious abortion and to identify congenital lesions. Most infectious causes of abortion have subtle gross lesions, and the majority of aborted fetuses are autolyzed. Whole fetuses can be submitted fresh on ice to most diagnostic labs for necropsy.

- **Fresh and formalin fixed fetal tissues**: Necropsy can be performed on the farm and tissues submitted fresh and formalin-fixed for laboratory testing and histopathology. Critical fresh tissues and fluids to collect are outlined on the abortion screen below, and include fetal abomasal fluid, which is essentially
amniotic fluid, and fetal thoracic or peritoneal fluid, which is used for fetal serology. Histopathology should include a representative section of all major organs including the brain, heart and diaphragm.

**Common Infectious Causes of Abortion in Ewes and Does**

- **Chlamyphila abortus**: A common cause of small ruminant abortion in Western North America, *C. abortus* is shed in vaginal secretions, afterbirth, semen and feces and is perpetuated in a herd by subclinically infected individuals via oral-nasal and venereal transmission. *C. abortus* is also perpetuated by avian reservoirs. Environmental contamination is a serious problem where sheep and goats are exposed to soiled bedding and feed. The bacterium causes early fetal reabsorption and common late term abortion with still and weak born lambs and kids. Aborting females are moderately sick and continue to shed organism for up to 3 months after abortion. Affected animals develop short term immunity lasting approximately 3 years, with recurrence of abortion in mature animals following waning immunity. Naïve animals are particularly sensitive with high rates of abortion and illness. This organism is an important zoonotic risk to handlers and particularly pregnant women.

- **Coxiella burnetii**: *C. burnetii* is shed chronically in feces, semen and milk, but particularly high numbers of organisms are shed vaginally and in afterbirth at the time of parturition or abortion and for several weeks to months afterwards. Subclinical does and ewes shed again at subsequent births, leading to significant environmental contamination. *C. burnetii* is spread by oral-nasal contamination and causes early embryonic reabsorption and common late term abortion and stillbirth, with naïve ewes and does most commonly affected. *C. burnetii* is a particularly important pathogen in goats and is a serious zoonotic pathogen, with particular risk for immunosuppressed people and pregnant women.

- **Campylobacter fetus fetus in sheep and C. jejuni jejuni in sheep and goats**: *C. fetus* and *jejuni* is shed in vaginal secretions and feces of clinical and subclinically infected sheep and goats and is particularly hardy in the environment with efficient contamination of bedding and feed and additional dispersal by birds and animals. *Campylobacter* is a common cause of sporadic late term abortion in sheep and especially naïve ewes, resulting in abortion rates of 5 to 35%. Immunity post-abortion is long term though bacterial contamination is perpetuated within the herd affecting new introductions in subsequent years. Affected ewes can present clinically with limited diarrhea and recover without incident, with many aborting ewes completely non-clinical. *Campylobacter* is an important enteric zoonosis for people.

- **Toxoplasma gondii**: *T. gondii* is spread by feline reservoirs via fecal contamination of bedding and feed materials. It is a common cause of early embryonic reabsorption, late term abortion, mummification, stillbirth, and weak born young in naïve sheep and goats and can affect anywhere from 5% to 100% of the herd. The dam is generally clinically unaffected and develops long term immunity. Though sheep and goats are dead-end hosts for this pathogen, environmental exposure to *T. gondii* can be a zoonotic risk for people and animals and especially pregnant women.
• **Other infectious causes of abortion:** Less common causes of abortion in sheep and goats include

**Bacteria:**  
- *Listeria monocytogenes*  
- *E. coli*  
- *Brucella ovis* or *mellintensis*  
- *Salmonella* sp.  
- *Mycoplasma* sp.  
- *Leptospira* sp.

**Viruses:**  
- Blue tongue virus (orbivirus)  
- Border disease virus (pestivirus)  
- Cache Valley fever (bunyavirus)

**Protozoa:**  
- *Neospora caninum*

• **Non-infectious causes of abortion:**

**Dietary deficiencies:**  
- Copper  
- Selenium  
- Iodine

**Physical or environmental stress / trauma:**  
- Heat or cold stress  
- Physical exertion / handling  
- Predation  
- Parasitism

**Metabolic disease in the dam:**  
- Pregnancy toxemia  
- Starvation / malnutrition  
- Systemic diseases (infectious, degenerative, neoplastic)

**Small Ruminant Abortion Screen:** The Diagnostic Medicine Laboratory at Colorado State University Veterinary Teaching Hospital offers a small ruminant abortion screen covering the four most common abortifacients as well as border disease virus and aerobic bacteria. Details of this screen can be found on the DMC web page at the following address: [http://www.dlab.colostate.edu/security2/test_info/661.cfm](http://www.dlab.colostate.edu/security2/test_info/661.cfm). The screen is intended to be an all-inclusive tool for detecting infectious abortion, though individual tests can be tailored to the needs of each farm based on herd history, risk factors and previous diagnostics. In making the decision on which samples to submit, careful attention should be paid to each of the 3 components of abortion: the dam, the placenta and the fetus. Importantly, submission of more than one abortus is often very helpful as there may be multiple etiologies involved and individual variation in lesions and cultures may not be representative of the herd problem. Additionally, whole fetuses can also be submitted for necropsy and abortion screen, if desired. Most veterinary schools and many state laboratories offer similar abortion panels for small ruminants and particular tests may vary.
# Ovine and Caprine Abortion Screen

<table>
<thead>
<tr>
<th>Lab</th>
<th>Agent</th>
<th>Test</th>
<th>Sample</th>
<th>Submission</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacteriology</strong></td>
<td><em>Brucella ovis</em></td>
<td><strong>Aerobic Culture</strong></td>
<td><strong>Fetal lung</strong>&lt;br&gt;<strong>Fetal Liver</strong>&lt;br&gt;<strong>Abomasal contents</strong>&lt;br&gt;<strong>Placenta (cotyledon &amp; intercotyledonary space)</strong></td>
<td><strong>Tissues:</strong> Fresh on ice / frozen <strong>Fluids:</strong> Red top tube (RTT) on ice / frozen</td>
</tr>
<tr>
<td></td>
<td><em>Brucella melitensis</em></td>
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<tr>
<td></td>
<td><em>Campylobacter sp.</em> Misc. Aerobes</td>
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<tr>
<td><strong>Molecular Diagnostics</strong></td>
<td><em>Chlamydophila abortus</em></td>
<td><strong>PCR</strong></td>
<td><strong>Fetal lung</strong>&lt;br&gt;<strong>Fetal Liver</strong>&lt;br&gt;<strong>Placenta (cotyledon &amp; intercotyledonary space)</strong></td>
<td><strong>Tissues:</strong> Fresh on ice / frozen</td>
</tr>
<tr>
<td></td>
<td><em>Coxiella burnetii</em></td>
<td><strong>PCR</strong></td>
<td><strong>Fetal lung</strong>&lt;br&gt;<strong>Placenta (cotyledon &amp; intercotyledonary space)</strong></td>
<td><strong>Tissues:</strong> Fresh on ice / frozen</td>
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<tr>
<td></td>
<td><em>Toxoplasma gondii</em></td>
<td><strong>PCR</strong></td>
<td><strong>Fetal brain</strong>&lt;br&gt;<strong>Fetal heart</strong>&lt;br&gt;<strong>Placenta (cotyledon)</strong></td>
<td><strong>Tissues:</strong> Fresh on ice / frozen</td>
</tr>
<tr>
<td><strong>Parasitology</strong></td>
<td><em>Toxoplasma gondii</em></td>
<td><strong>MAT (agglutination)</strong></td>
<td><strong>Fetal peritoneal fluid</strong></td>
<td><strong>Fluids:</strong> RTT on ice / frozen</td>
</tr>
<tr>
<td><strong>Virology</strong></td>
<td><em>Border Disease Virus</em></td>
<td><strong>IFA</strong></td>
<td><strong>Fetal lung</strong>&lt;br&gt;<strong>Fetal Liver</strong>&lt;br&gt;<strong>Fetal kidney</strong>&lt;br&gt;<strong>Fetal spleen</strong>&lt;br&gt;<strong>Fetal thymus</strong>&lt;br&gt;<strong>Placenta (cotyledon &amp; intercotyledonary space)</strong></td>
<td><strong>Tissues:</strong> Fresh on ice / frozen</td>
</tr>
<tr>
<td></td>
<td><em>Toxoplasma gondii (sheep)</em></td>
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**Histopathology (4 slides)**
- **Tissues:** Fresh on ice / frozen **Serum:** Separated or RRT, on ice / frozen **Submit paired samples together**

## Comprehensive Panel

| Serology             | *Chlamydophila abortus*<br>*Coxiella burnetii* (phase I/II)<br>*Brucella sp.*<br>*Toxoplasma gondii*<br>*Campylobacter sp. (sheep)* | ELISA<br>IFA and Titer<br>ELISA<br>MAT<br>L. Agglutination | **Acute and convalescent serum**<br>**Acute and convalescent serum**<br>**Acute only**<br>**Acute only**<br>**Acute and convalescent serum** | **Serum:** Separated or RRT, on ice / frozen **Submit paired samples together**
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<tbody>
<tr>
<td>Chemistry / Toxicology</td>
<td><em>Copper analysis</em></td>
<td><strong>Flame AAS</strong></td>
<td><strong>Fetal liver</strong></td>
<td><strong>Tissues:</strong> Fresh on ice / frozen</td>
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## Additional Tests

<table>
<thead>
<tr>
<th>Virology</th>
<th><em>Blue Tongue Virus</em></th>
<th><strong>PCR</strong>&lt;br&gt;Serology</th>
<th><strong>Fetal lung</strong>&lt;br&gt;<strong>Fetal brain</strong>&lt;br&gt;<strong>Fetal peritoneal fluid</strong></th>
<th><strong>Tissues:</strong> Fresh on ice / frozen <strong>Fluids:</strong> RTT on ice / frozen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parasitology</td>
<td><em>Neospora caninum</em></td>
<td><strong>PCR</strong></td>
<td><strong>Fetal brain</strong>&lt;br&gt;<strong>Fetal heart</strong>&lt;br&gt;<strong>Placenta (cotyledon)</strong></td>
<td><strong>Tissues:</strong> Fresh on ice / frozen</td>
</tr>
<tr>
<td>Parasitology</td>
<td><em>Neospora caninum</em></td>
<td><strong>ELISA</strong></td>
<td><strong>Fetal peritoneal fluid</strong></td>
<td><strong>Fluids:</strong> RTT on ice / frozen</td>
</tr>
<tr>
<td>Chemistry / Toxicology</td>
<td><em>Nitrate</em></td>
<td><strong>Nitrate Analysis</strong></td>
<td><strong>Fetal eye</strong></td>
<td><strong>Tissues:</strong> Fresh on ice / frozen</td>
</tr>
</tbody>
</table>

^ Tissues will not be pooled unless otherwise indicated.
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