WASHINGTON STATE UNIVERSITY

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Bovine Viral Diarrhea Virus in Camelids

1. **What is BVDV?**
   Bovine Viral Diarrhea Virus (BVDV) is one of several world-wide pestiviruses known to infect domestic and wild ruminants, camelids, and swine. For cattle producers the virus causes economic losses through decreased weight gains, decreased milk production, reproductive losses, and death. As with most viral infections, there is a wide range of clinical signs from inapparent infections to diarrhea, respiratory tract infections, hemorrhage, abortions, congenital defects, and death.

   Acute Infection:

   Bovine viral diarrhea refers to a mild disease caused by a BVD virus infection in immunocompetent cattle (i.e. cattle with a normal functional immune system). In general, animals develop acute BVD 10-12 days after infection. Fetal infection in the first trimester of gestation can result in abortion or the development of a mummified fetus. Congenital defects can result when the fetus is infected with BVDV in late first, second and early third trimester of gestation. The most common defect is cerebellar hypoplasia (incomplete development of the cerebellar portion of the brain). Infection late in the pregnancy usually results in the birth of clinically normal calves.

   Persistent Infection:

   BVDV can lead to a persistent infection in a calf if it is infected during a certain time in gestation (approximately 40-150 days gestation). If infected prior to complete development of the fetal immune system, the virus will not be recognized as a foreign pathogen. After birth, the calf will shed the virus and infect other animals in the herd. Sometimes these calves look sick but they can also look perfectly healthy thereby making it impossible to visually identify these animals.

2. **Why is BVDV important to my alpacas or llamas?**
   This question cannot be completely answered at this time. There is much research that needs to be performed to fully understand the implications of BVDV in alpacas and llamas.

   Research has shown that llamas and alpacas can be infected with the virus and develop clinical signs. There have also been reports of suspected persistent infections in crias. In cattle, persistent infected calves are the primary source of spreading the infection to other animals. It is not known if persistently infected crias are the primary source of camelid herd infection, but is suspected. Alpacas and llamas are sent all over North America and lapses in biosecurity could permit a persistent infected cria to infect other animals and herds.

3. **What are some concerns among veterinarians and researchers regarding BVDV in alpacas and llamas?**
   A few current questions among veterinarians and scientists requiring investigation: Are there true persistent infections or longer transient infections than seen in cattle? How accurately do the bovine-based tests diagnose infections in camelids? Is there a new pestivirus specific to camelids or a mutation of the BVD virus that appears to “prefer” camelids?

4. **What are some possible clinical signs seen in alpacas and llamas?**
   Typical signs that a client may see include fever, oral ulcers, anorexia, diarrhea, abortion, ill-thrift, and congenital defects.

5. **How is BVDV transmitted?**
   The most efficient method of BVDV transmission in camelids is not known. Transmission in cattle has been primarily by ingestion or inhalation of the virus. The virus can be found in all body fluids (respiratory and oral secretions, urine, milk, and semen) and feces. Transplacental (cow to fetus) transmission also occurs. Transmission is assumed to be similar in other susceptible species including alpacas and llamas.

6. **What species can transmit BVDV?**
   Virus can potentially spread between domestic ruminants (cattle, sheep, goats), camelids, and wildlife (deer, elk, etc).

7. **Is there a vaccine available for alpacas and llamas?**
   Currently there is no BVDV vaccine licensed for use in camelids. There are several vaccines available for use in cattle. The vaccines do not prevent infection but reduce the clinical disease effects. At this time, it is not recommended to vaccinate camelids until more is understood about the virus to prevent interference in testing and identifying truly infected animals.

8. **Can BVDV infections be prevented?**
   No, BVDV infections can not be prevented but they can be reduced. Maintaining a closed herd, implementing strict biosecurity protocols for all incoming animals (recommended not just for reducing BVDV infections), and periodic screening of open herds can reduce the occurrence.

9. **What diagnostic techniques are currently recommended for alpacas and llamas?**
   Types of Tests Available
   - Polymerase chain reaction (PCR) – nucleic acid detection, very sensitive. Will detect persistent as well as acute (transient) infections.
   - Antigen-enzyme-linked immunosorbent assay (Ag-ELISA) – antigen detection; validation of this test has not been established in camelids but is being evaluated by WADDL.
   - Serology (serum neutralization) – antibody detection, a single test indicates exposure, but not active infection. Testing acute and convalescent samples (samples take 3-4 weeks apart) and showing a 4-fold increase in titer indicates active infection. False negatives may occur if sample taken soon after an infection (prior to development of an immune response), or in animals < 3 months of age when maternal, colostrum derived, antibodies interfere with the test.
   - Skin biopsy with immunohistochemistry (IHC) – antigen detection; results are not conclusive in camelids.
   - Virus isolation – Detects live virus in blood and tissues. May be required for virus typing.

   Testing Strategies:
   Acute Infection:
   BVDV acute infection can be diagnosed by virus isolation, polymerase chain reaction (PCR) or serology. Virus detection must be done in the first 3-10 days after infection. A whole blood sample is the best sample for BVDV detection by PCR or virus isolation. Paired acute and convalescent samples collected 3-4 weeks apart are required to identify 4-fold increase in serum antibody titers following recovery from clinical illness.

   Persistent Infection:
   Definitive diagnosis of persistent infection in camelids cannot be based upon testing done at a single time point. Detection of BVDV persistent infection requires showing virus is present in a particular animal over time (the infection persists). Although the BVDV antigen ELISA test done at a single time point is used to detect BVDV persistent infection in cattle, whether or not similar interpretation of the test in camelids is accurate is not known. Therefore, persistent infections in camelids should be determined by detecting virus (by PCR or virus isolation) in sequential samples collected 3-4 weeks apart.

10. What are some current testing recommendations for alpacas and llamas?

The following tests are recommended by the Washington Animal Disease Diagnostic Laboratory (WADDL) and Washington State University Veterinary Teaching Hospital (WSU-VTH) for testing alpacas and llamas. These are based on the most current information available and may change as research is completed. Herds should be examined on a case-by-case basis as testing may not be warranted in some situations.

WADDL and WSU-VTH Testing Recommendations in Camelids

Please submit whole blood (purple top tube, PTT) and serum (red top tube, RTT) for each animal to be tested.

- HERD SCREENING
  - Submit two blood samples (purple top tube, PTT and red top tube, RTT) individually marked to WADDL.
  - WADDL will test PTT sample for BVDV by PCR. Up to 10 samples can be pooled and tested, which may reduce testing costs. Negative pools would be reported as BVDV not detected. Individual samples from positive pools would be retested to identify individual positive animals.
    - Negative results = no BVD infected animals
    - Positive results = persistent or transient BVD infection suspected
      - Definitive diagnosis of persistent infection requires submission of another blood sample (PTT) from an individual positive sample to be collected in 3-4 weeks then re-tested.
  - Samples can also be used to check for BVDV antibody to determine prior exposure/immunity through serologic testing (RTT).
  - If unable to test entire herd, test all juveniles less than 2 years old and breeding males and females. Again, diagnosis of BVDV persistent infection would require 2 blood samples collected 3-4 weeks apart.

- NEW ARRIVALS TO A HERD
  - Quarantine for minimum of 30 days.
    Quarantining is not only important to allow screening for BVDV but also for other diseases. Herd biosecurity is important to protect your herd from diseases new animals may bring with them. For animals that will be remaining on your property a minimum 30-day quarantine is recommended before introducing new animals to your herd. This will not prevent all possible infections but reduces the opportunity for disease transmission.
  - Submit two blood samples (purple top tube, PTT and red top tube, RTT) individually marked to WADDL.
  - Test with PCR (PTT)
    - Negative results = no BVD infection
    - Positive results = persistent or transient infection suspected
      - Remain in quarantine until retested in 3-4 weeks
        - Negative test = most likely a transient infection
        - Positive test = persistent infection suspected
      - A negative-tested dam can be returned to the herd, but recommend quarantining just before delivery until newborn cria is tested with PCR and identified as BVD infected or not.

- OTHER RECOMMENDED TESTS
  - Necropsy and test all aborted and stillborn crias and crias or adults with unexplained deaths. Submit whole blood (PTT) and serum (RTT) from the respective dam as well.
  - In addition to performing an abortion screen it is a good opportunity to evaluate the herd's trace mineral status.

11. Who to contact for more information?

- Contact WADDL (509)335-9696 for testing questions.
- Contact WSU-VTH Agriculture Animal Department, Ms. Sallie Bayly, RVT (509-335-0711 shenson@vetmed.wsu.edu) to contact a veterinarian regarding management questions.
- WADDL and WSU-VTH veterinarians who can assist you: Dr. Jim Evermann (WADDL); Dr. Andy Allen, Dr. George Barrington, Dr. Stacey Byers, Dr. Cheryl Fite, Dr. Steve Parish, Dr. Ahmed Tibary.
- www.vetmed.wsu.edu/depts_waddl/BVDCamelids.asp

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