Bovine Abortions

- Kerry A. Rood, MS, DVM

Causes of abortion

- Infectious
  - Virus
  - Bacteria
  - Protozoa
  - Fungus
- Non-infectious
  - Stress
  - Toxins
Causes of Bovine Abortion
Laboratory Submissions

- SD State University Lab
  - Bacterial = 14%
  - Viral = 11%
  - Fungal = 5%
  - Other = 2%
  - Lesions but no agent found = 17%
  - No Diagnosis = 51%

Causes of Bovine Abortion at three Laboratories

<table>
<thead>
<tr>
<th>SD State Lab*</th>
<th>CA Diagnostic Lab*</th>
<th>UVDL¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Viral = 11%</td>
<td>- V = 3%</td>
<td>- V = 5%</td>
</tr>
<tr>
<td>- Bacterial = 14%</td>
<td>- B = 17%</td>
<td>- B = 5%</td>
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<tr>
<td>- Fungal = 5%</td>
<td>- Protozoan = 23%</td>
<td>- Protozoan = 20%</td>
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<tr>
<td>- Other = 2%</td>
<td>- Other = 1%</td>
<td>- Other = 5%</td>
</tr>
<tr>
<td>- Lesions but no agent found = 17%</td>
<td>- Lesions but no agent found = 16%</td>
<td>- Lesions but no agent found = 15%</td>
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<tr>
<td>- No diagnosis = 51%</td>
<td>- No Diagnosis = 40%</td>
<td>- No Diagnosis = 50%</td>
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</tbody>
</table>

*Information from KSU
¹Utah Veterinary Diagnostic Laboratory, Personal Communication with Dr. Skrøvetranas
Submissions for work up to UVDL

- As fresh as possible

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**Brucellosis in Cattle**

- **Bacteria** = *Brucella abortus*
- Important (regulatory disease) but no longer seen in most states.
  - Control program for years
  - Bangs testing and metal ear tags
- Abortion is typically after 5th month
- Vaccine (given by an accredited veterinarian)
  - RB51 replaced strain 19
  - between 4 – 12 month of age
Bovine Viral Diarrhea Virus (BVDv)

- genus Pestivirus in the family Flaviviridae

- What other diseases are cousins?
  - hog cholera virus, also known as classical swine fever virus
    - USDA Secretary Bob Bergland declared US hog cholera free on January 31, 1978
  - Border Disease (Hairy shaker disease) of sheep

BVDv types

- The virus presents in different forms
  - Cytopathic or Noncytopathic
    - type 1 or type 2, type 1a, 1b; 2a, 2b
- All of this makes for confusion when selecting vaccines and testing for the disease.
- The virus may exist in multiple species and transmission from one to the other may occur
  - South America Camelids
Bovine Viral Diarrhea (BVD)

- Incubation period of 7-9 days
- Characterized by
  - High temperature (105-107 F)
  - Nasal discharge
  - Rapid breathing
  - Loss of appetite
  - Diarrhea
- Causes abortions in pregnant cows (3-6 weeks after infection)
- Decrease in milk production in lactating cows

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Bovine Viral Diarrhea (BVD)

- BVDv may infect cattle of any age.
- BVD is a disease that diminishes production; and in the individual impacts multiple body systems
  - Reproductive
  - Respiratory
  - Digestive
  - Immune systems.
- Clinical signs can vary
  - Pneumonia
  - Abortions
  - Stunted calves
  - Stillbirths
  - Weak calves
  - Unthriftiness
  - Increase disease susceptibility
  - Full blown disease characterized by a watery diarrhea that frequently leads to death.
**Transmission and Sources of BVD**

- **Transmitted by**
  - Ingestion
  - Inhalation
  - Insects
    - Face flies (*Musca autumnalis*). (Gunn, 1993)
    - Stable flies (*Stomoxys calcitrans*)
    - Horseflies (*Haematopota pluvialis*)
    - Head flies (*Hydrotæa irritans*).
  - Carried on boots and vehicles (fomite)

- **Sources**
  - transient infected animals including wildlife
  - Persistently infected animals are the main source of infection. PI’s shed viruses in high numbers and infect others, even if they are vaccinated.
  - PI calves result from the dam being exposed during the first third of pregnancy

**Possible Outcomes to BVDv Infection**

<table>
<thead>
<tr>
<th><strong>Fetal Infection</strong></th>
<th><strong>Acute Infection to calves or adults</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Embryonic Death</td>
<td>Subclinical—no signs of disease</td>
</tr>
<tr>
<td>Abortion</td>
<td>Severe BVD signs with diarrhea and lesions in the gut (mouth to anus)</td>
</tr>
<tr>
<td>Stillbirths</td>
<td>Hemorrhagic Syndrome (failure of blood to clot normally)</td>
</tr>
<tr>
<td>Congenital Birth Defects (eye defects, brain defects)</td>
<td>BVD infection and respiratory disease (pneumonia)</td>
</tr>
<tr>
<td>PI Calves (immunotolerant persistently infected shedders)</td>
<td>Normal Calves born with antibodies to the BVD virus</td>
</tr>
</tbody>
</table>
Possible Outcomes to BVDv Infection  
(Continued)

**Mucosal Disease**

- Infection of PI calves with a CPE (cytopathic) virus which causes severe diarrhea, weight loss, damage to the gastrointestinal system, and death.

**BVDv Infection During Gestation**

- Infertility
- Repeat breeding
- Congenital defects
- Immune response
- Persistent infection
- Abortion, stillbirth
BVD Review

- BVD can cause a variety of clinical and subclinical reproductive, enteric, and respiratory syndromes and immune suppression.

- BVD is unique in that a fetus that is infected from its transiently or persistently viremic dam prior to formation of a competent immune system can become persistently infected (PI) with the virus.

- PI animals will shed BVD from body secretions throughout their life.

- PI animals are considered the primary reservoir for BVD in both cow herd and feedlot situations.

BVD Economic impact

- A current estimate
  - ~ 10% of beef cow herds have at least one (1) PI animal
  - about 0.25 to 1% of calves born are PI

- Veterinarians/Producers should have a surveillance strategy to determine level of herd risk for the presence of PI animals (High vs. Low Risk).

- Researchers at Ohio State University screened 18,931 calves in 128 beef herds located in five US states for PI calves.
  - 76 herds were randomly selected
  - 52 herds were selected by veterinary practice giving “suspect” classification
  - Random = 3/76 – PI calves = 4%
  - Suspect = 10/52 – PI calves = 19%

T.E. Witter et al., 2001
Table 1. Frequency and prevalence of beef herds identified with calves persistently infected with BVDV (confirmed and probable) in five US states in 1996

<table>
<thead>
<tr>
<th>State</th>
<th>Average calves per herd</th>
<th>Total herds tested</th>
<th>Herds with PI calves</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R (random)</td>
<td>S (suspect)</td>
<td>R</td>
<td>S</td>
</tr>
<tr>
<td>Alabama</td>
<td>31</td>
<td>13</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Nebraska</td>
<td>171</td>
<td>27</td>
<td>24</td>
<td>4</td>
</tr>
<tr>
<td>Nevada</td>
<td>259</td>
<td>10</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>North Dakota</td>
<td>158</td>
<td>14</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Ohio</td>
<td>54</td>
<td>12</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>


Financial impact of BVD

- **$10.00 to $24.00 per breeding animal**
  - conservative estimate based on value of the cow and the lowered calf crop
  - 200 head cow herd would lose $2,000 to $4,800 per year.

- **In the feedlot, economic impact can be tremendous.**
  - $21,000 to $100,000 have been lost in a few weeks by feedlots.

- **Herds that are considered high risk for containing PI animals should utilize laboratory tests to do whole-herd screening to find all PI animals and then remove them.**

Source: AVC - BVD control
Disease awareness

- Academy of Veterinary Consultants (AVC)
  - “It is the resolve of the Academy of Veterinary Consultants that the beef and dairy industries adopt measures to control and target eventual eradication of BVDV from North America.”

- American Veterinary Medical Association (AVMA)
- American Association of Bovine Practitioners (AABP)
- National Cattlemen’s Beef Association (NCBA)
- United States Animal Health Association (USAHA)
- National Western Stock Show and Utah Beef Improvement Association (UBIA) require testing

ATTENTION - VERY IMPORTANT!!

BOVINE VIRUS DIARRHEA - persistent infection

The National Western Stock Show, as a responsible leader of the livestock industry, beginning with the 2008 show, will be requiring that all beef cattle, bison, yak and camelsids shown and sold during its event, show proof of a negative PI test for BVD. The National Western is in support of the AABP NCBA Cattle Health and Well-being Committee and the Academy of Veterinary Consultant’s position stating responsible disposition of BVD persistently infected animals is an important component of BVD control.

BVD is a disease that is damaging to the industry. Cattle owners have a moral and ethical obligation to the beef industry not to sell known diseased or damaged animals without full disclosure.

Background:

* Persistently infected (PI) cattle are the major source for BVD infection and disease in cattle that come in contact with them. PI cattle become infected before they are born (about 45 - 125 days of gestation) and shed huge amounts of BVD virus throughout their lives.
* The common ways BVD is introduced into herds are through herd additions that are PI or contact with other PI cattle - including PI calves, yearlings, bulls, females and fetuses carried by pregnant females.
* Any calf, replacement heifer, bull or cow can become temporarily infected with BVD virus for a few days to weeks until their immune system can clear the virus. The disease is usu-ally not fatal by itself, but BVD virus suppresses the immune system and makes infected cattle more susceptible to diseases such as pneumonia, scours, foot rot and others. The virus may also cause infertility and/or abortion in susceptible cows, heifers and bulls.
* Testing for PI cattle is different than testing for many other animal diseases in that PI status stays the same throughout the animal’s life. In other words, a non-PI animal will be negative its entire life and a PI animal will remain so its entire life. Because of this fact, PI testing is usually done once. A test for PI status only needs to be repeated to confirm a positive, or if evidence indicates, a faulty test. As with all tests, a few false-positive and false-negative results can occur.
* PI animals are defective. Their status should be disclosed and the marketing or movement of these animals in any manner that causes exposure to non-infected cattle is an act that ignores a cattleman's ethical obligation to the industry.

Meet with your veterinarian to determine or review your BVD goals and current exposure risk. The dilemma of how to deal with known PI cattle becomes more critical as BVD testing becomes more widespread. Appropriate disposition of known PI cattle must take into account the adverse impact these cattle have on health, welfare and the economic return of other cattle and cattle operations they may expose.

We appreciate your support on this matter! If you have questions, please call 303-239-4161 or 303-299-5357.

Bovine Virus Diarrhea
BVDv Control

- **Vaccination(s)**
- **Biosecurity**

My opinion – producers have relied too heavily on vaccinations as their only strategy in controlling BVDv. Biosecurity principles are just (if not more) important than vaccination protocols.

  - Human side – pandemic influenza
    - Wash hands
    - Shelter in place

Why will vaccination alone not control BVDv?
1. No vaccine is 100% effective – some are close – but not perfect.
   - Potential vaccine breaks or failure based too much exposure
2. Different herd mates have different stages of immunity
   - Some animals in the herd may not seroconvert (respond to vaccine)

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Keys to controlling BVD

- Understand “persistently infected” (PI) animals as they relate to BVD.
- Not be willing to live with one or more PI calves in a herd.
- Not be willing to keep a PI calf as a replacement heifer or breeding bull. (don’t sell them either)
- Commit to finding BVD PI cattle in the herd
How to Control BVDv in your herd

- Test entire herd the first year
  - At least entire calf crop, additions, and all bulls
- Test entire calf crop prior to breeding in subsequent years
  - Birth
  - Processing (castration)
  - Branding
- Test all additions to herd – preferably prior to purchase
  - Purchased Heifers
  - Purchased Bulls
  - Project calves (club calves, etc)
- Administer a modified live vaccination protocol each year for BVDv
  - Ideally month prior to breeding season
- Enact a strict biosecurity plan

Fig 35-4. Obtaining an ear notch tissue sample for immunohistochemical diagnosis of BVD infection (Courtesy of Mark Kirkpatrick)
Fig 35-5. Immunohistochemical techniques help veterinarians visualize the BVD virus in ear tissue (Courtesy of Mark Kirkpatrick)

Infectious Bovine Rhinotracheitis (IBR)

- Acute, contagious virus
  - Bovine Herpesvirus 1
- Spread via direct contact
- Most abortions after 4 month gestation
- In a storm, can affect over 50% of herd
- Abortions usually occur 1-2 months after initial infection
- Vaccine
  - Usually in combination with BVD, PI3, BRSV
- Modified live implicated
Interactions Among Microbial Pathogens, Host Resistance, and the Environment

Cow Factors
- Anatomy
- IM defense
- Nutrition
- Lactation Stage
- Age

Pathogen Factors
- Toxins
- Virulence Factors
- Antimicrobial Resistance

Environment
- Management
- Housing
- Milking Equipment
- Climate
- Feeding

Increased Risk of Disease

Vaccination Strategy

• Questions
  – What type of animals and age?
  – What diseases are most common in my area?
  – What am I trying to prevent?
  – Is there good management coupled with the vaccine?

• Consultation with your veterinarian is a must!
Role of Vaccination

• Useful tools
  – No vaccine is 100% effective
  – Must be used according to label instructions

• Used in conjunction with other best management practices
  – Nutrition
  – Husbandry
  – Welfare

Vaccine Protocol

• Vaccines are not the panacea
  – are few silver bullets

• Key factors
  – Minimize stress
  – Focus on susceptible first (youngest)
  – Most vaccines require booster (2-4 weeks)
    • Poses a problem when cattle are turned out
  – Vaccinate cows 4-6 weeks prior to birth for “rich” colostrum

• Use reputable companies and products
Stress

• Fight or flight mechanism
  – Stress
  – Release of adrenal cortisol (steroids)
  – Immune system suppression
  – Increased susceptibility to pathogens
Immunology

- Passive
  - Maternal Antibodies (colostrum)
  - Absorbed with colostrum in first few hours of birth
  - Temporary and wanes over time
- Active
  - Self generate – mount immune response
  - Takes time to develop
  - Can develop memory (ideal)
Passive vs Active Immunity
(vaccination before weaning)

Modified Live Virus (MLV) vs Killed

- **B lymphocytes**
  - All vaccines stimulate
  - Memory cells
  - Produce Antibody
  - Next exposure to antigen $\rightarrow$ high antibody titers

- **T lymphocytes**
  - Two populations
    - CD4$^+$ T cells (helper T cells)
      - Capture and present antigens to other immune cells
    - CD8$^+$ T cells (killer T cells)
      - Identify infected host cells and destroy
    - Killed vaccines only stimulate CD4$^+$ T cells, MLV vaccines stimulate both
Product Handling

- MLV vaccines are precisely that
  - Living, growing, dividing viruses, treat them as such
    - Never let vaccine reach room temp.
    - Mix up only what you will use in 1-2 hours
    - Keep out of direct sunlight
      - UV rays kill viruses
    - If possible, keep everything, including multi-dose syringes, cool while in use

Advantages

<table>
<thead>
<tr>
<th>Modified Live</th>
<th>Killed</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Single Dose</td>
<td>□ More stable</td>
</tr>
<tr>
<td>□ Cost savings?</td>
<td>□ Less fear of contamination and causing disease</td>
</tr>
<tr>
<td>□ More Complete immune response; CMI and Humoral (antibodies)</td>
<td>□ Less Concern with stage of pregnancy</td>
</tr>
<tr>
<td>□ Longer duration of immunity</td>
<td>□ Companies can incorporate new strains quickly</td>
</tr>
</tbody>
</table>
## Disadvantage

<table>
<thead>
<tr>
<th>Modified Live</th>
<th>Killed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Require more careful handling</td>
<td>MULTIPLE DOSES REQUIRED WITHIN SET TIME for immunization</td>
</tr>
<tr>
<td>Easily inactivated by improper storage</td>
<td>More costly per dose (£)</td>
</tr>
<tr>
<td>Must be used within hours of reconstitution</td>
<td>Cell-mediated immune response may be sub-optimum with shorter duration of immunity</td>
</tr>
<tr>
<td>Risk of introducing contaminants during mixing</td>
<td>Require adjuvants</td>
</tr>
<tr>
<td>Avoid exposure to disinfectants</td>
<td>additives needed to increase immune response to vaccine</td>
</tr>
<tr>
<td>Not recommended for all stages of gestation — i.e., potential to cause abortions</td>
<td>chemicals can also cause tissue damage and other side effects</td>
</tr>
<tr>
<td>Can be sensitive to antibody interference</td>
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</tbody>
</table>
Tips for vaccine handling

- Always use properly cleaned equipment
  - Multiple dose, reusable syringes washed in hot, distilled water
- Sharp needles and correct size
  - Change needles frequently
    - Reduce BLV risk
  - Never re-enter a vaccine bottle with used needle
- Subcutaneous injections
  - Follow label instructions
  - Neck region

Vaccination tips continued

- Read the label
  - Store in correct temp
  - Make sure distributor stores correctly
  - Pay attention to temperature and light
- Mix only one bottle at a time
  - Rule of thumb – mix only enough to be used in one hour
- Store in cooler chuteside and when transporting
Vaccination tips continued

- Select a quality product
  - Base on research
  - Consult with your veterinarian
  - Make sure they are federally approved and licensed
- Consult your veterinarian
  - Schedule
  - Use
  - Product

Vaccination Recommendations

<table>
<thead>
<tr>
<th>Livestock Type</th>
<th>Date-Pre-calving</th>
<th>Calving</th>
<th>Branding</th>
<th>Pre-breeding</th>
<th>Pre-weaning</th>
<th>Weaning</th>
<th>Preg-check</th>
<th>Post-weaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALVES</td>
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<td>HEIFERS</td>
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<td>BULLS</td>
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- 5 Way (IBR, PI3, BVD, BRSV)
- Clostridial (8 way)
- Trich vaccine in cows
- Scour prevention
## Vaccination Recommendations

<table>
<thead>
<tr>
<th>Livestock Type</th>
<th>Pre-calving</th>
<th>Calving</th>
<th>Branding</th>
<th>Pre-breeding</th>
<th>Pre-weaning</th>
<th>Weaning</th>
<th>Preg-check</th>
<th>Post-weaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALVES</td>
<td></td>
<td></td>
<td>Bovi-Shield Gold Oneshot Ultra 8 Dectomax</td>
<td>Premvac 34 Bovi-Shield Gold Oneshot Ultra 8 Dectomax</td>
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<td></td>
<td></td>
<td>At Range Visit Bovi-Shield Gold 51</td>
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<tr>
<td>BEEFERS</td>
<td>ScourGuard</td>
<td></td>
<td></td>
<td>Bovi-Shield Gold VL5 Dectomax</td>
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<td></td>
<td>Per Label ScourGuard first dose UC CD first dose</td>
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<tr>
<td>COWS</td>
<td>ScourGuard</td>
<td>Ultra Bac 8</td>
<td>Bovi-Shield Gold VL5 Dectomax</td>
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<tr>
<td>BULLS</td>
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<td></td>
<td>Fertility Test Bovi-Shield Gold VL5 Dectomax</td>
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<tr>
<td>STOCKERS</td>
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<td></td>
<td>Bovi-Shield Gold DMX/Oneshot OSU (optional)</td>
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</tbody>
</table>

* BS=Bovi-shield Gold OSU=One Shot Ultra UC=Ultra Choice DMX=Dectomax UB=Ultrabac*