Bovine Viral Diarrhea

Adapted from a slide set by David R. Wolfgang, V.M.D.
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BVDV

- Member of the Pestivirus
- Identified in cattle 1946
- Initial episodes were associated with gastro-intestinal disease
- In most herds, BVDV infection is now primarily associated with reproductive problems though acute outbreaks continue
BVDV: the virus

Two genotypes of virus have emerged:
Type I & Type II

- Type II was present in Canada in the early 1980’s
- Type II was isolated in acute clinical cases from Canada and NE USA in the mid 1990’s
- Both types are capable of causing severe disease
There are two biotypes of virus: cytopathic and noncytopathic.

For BVDV the biotype is defined by the growth characteristics of the virus in cell culture.

- Cytopathic strains kill cells in culture
- Noncytopathic strains do not cause cytopathology
What is a PI Animal?

- Infection of the fetus with non-cytopathic BVDV at less than 125 days of gestation can result in the production of a persistently infected (PI) calf.
  - Virus shedding is continuous for most of the animal’s life; most do not survive to adulthood.

- PI animals are the means by which BVDV is maintained in the bovine population.
Epidemiology

- Worldwide distribution in cattle
- European Countries are actively engaged in eradication programs
- Prevalence is believed to approach 80% of cattle herds in many regions
Epidemiology

15% of Dairy Herds are believed to contain at least one PI animal

- Persistently infected (PI) cattle range from 1 to 2% in a herd
- Majority of PI animals are young stock
Outbreak in Canada in the early 1990’s affected more than 10,000 cattle

Seven states have confirmed cases of the peracute form of Type II BVD

Estimates from the early 1990’s for adequate immunization for BVD

- 27% of Dairy Operations
- 13% of Cow Calf Operations
BVDV Infection

- 70 to 90% of infections are subclinical
- Upper respiratory tract and lymphoid tissues are the sites of virus replication
- Viremia starts 3 days to 8-10 days after infection but duration may be as short as 2-3 days for some cattle.
Sources of BVDV

- **PI animals are a greater risk**
  - lifetime of continuous viral shedding
  - higher levels of virus in serum and mucosal secretions

- **Acutely infected animals during viremia**
  - duration of shed is shorter: 4-7 days
  - viral levels in secretions are usually lower than in PI cattle
Viral Shedding
Transmission

- Vertical (dam to calf)
  - BVDV very efficiently crosses the placenta to infect the fetus at all stages of gestation

- Horizontal (between herdmates)
  - Direct contact - most efficient transmission
  - Short range aerosol transmission likely
  - Oral contamination of common feed and water supply
Typical Herd History

 Apt Herd has a history of inadequate immunization -  No MLV used or

- primer dose of killed vaccine was not followed with a booster dose

 Apt Animals are purchased

- Screening tests for BVD not performed
- New purchases are not isolated

 Apt Acute disease/abortions or early embryonic deaths begin in approximately 2 weeks
BVD Clinical Presentations

- Acute/peracute-high fever, off feed, diarrhea, death within 48 hours
- BVD associated diarrhea
- BVD associated pneumonia
- Hemorrhagic Syndrome-fever, diarrhea, severe platelet depression, death
- BVD associated reproduction problems and abortions
BVD Clinical Presentations

- Diarrhea
- Mucosal
- Acute
- Abortions
- Hemorrhagic
- Pneumonia
- Other

Laboratory reports 1994
Mucosal Disease
Pattern Following
Virus Introduction

Acute Disease in Susceptible Animals

Abortions and Early Embryonic Death

PI Animals

Weak or deformed calves
BVDV and Reproduction

In herds with inadequate immunity:

- Depression in the number and vitality of follicles
- Increased early embryonic deaths
- Increase in the calving interval
- Mid to late term animals may abort
In herds with inadequate immunity:
- Virus can be found in semen
- Virus can be found in fluid following embryo transfer
- Some calves will be born weak or with congenital defects
Pattern of Reproductive Disease

- Early embryonic death
- Day 35 -125 PI calves
- Three to Five Months Congenital Defects
- Abortions - most at 4-7 Months
- Normal calves with precolostral antibodies

Moenning, V., Vet Clinics Vol 11, 1995
BVDV and Reproduction

- Even the best immunization program has limited or no ability to protect fetus.
- Reproductive problems can persist despite an aggressive immunization program.
- A PI dam will always have a PI calf.
Economic Costs

- Acute disease of highly pathogenic strain may kill 25 to 40% of infected animals and cause severe milk depression and weight loss.
- Very small percentage of all BVDV infections are clinical.
Reproductive losses are the greatest economic costs on the typical farm.

- Infertility, early embryonic death and abortions
- Production of PI calves
The Costs of BVD

Acute Disease is not the greatest source of loss

The Trojan Horse effect of PI animals in the herd is the greatest economic drain.
Identifying BVD in the Herd
BVDV Tests

- Virus Isolation
  - tissue, whole blood, serum
- Antigen detection tests
  - BVDV Frozen Antigen test (FA)
- Antibody detection tests
  - BVDV Serum Neutralization (SN) test
- Nucleic acid detection - PCR test
Identifying BVDV in the Herd

Clinical cases

- Acute Infection - Virus isolation
- Abortions
  - Virus identification in fetal tissues and fetal membranes
  - Paired or cohort serology (4 fold change in titer)
- Early embryonic death
  - Paired or cohort serology
  - Identify virus in the herd
Identifying the BVDV PI Animal

- Diagnostic tests
  - Virus isolation
  - Microtiter plate assay
  - Immunohistopathology (biopsy sample)
  - Fluorescent antibody

- Reconfirm in 2 to 3 weeks if acute infection is suspected in the herd
Immunization Strategies

Modified Live Vaccines

Killed Virus Vaccines
Overview of Immune System

**Humoral Wing**
- B cells
- Plasma cells
- Memory cells
- Production of specific antibodies

**Cell Mediated Wing**
- Macrophages
- T cells
- Killer and helper cells
- Cytokines
- Destroy tumor cells and cells infected with virus
Modified Live Vaccines

 Advantages

- Single dose will provide protection
- Are less expensive per dose
- More rapid immune response
- Stimulate cell mediated and humoral wings of immune system
- Longer lasting protection
Modified Live Vaccines

▶ Disadvantages

▶ Can not be given to pregnant animals
▶ In calves less than 6 months of age they may not provide adequate antibody response
▶ Need to be reconstituted prior to use
▶ Can be inactivated by heat, sunlight
▶ Partial bottles can not be stored
▶ Conceivable to produce mucosal disease in PI
Antibody Response to ML Vaccine
Killed Virus Vaccines

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Advantages

- Can be used in all stages of lactation
- No risk of shedding
- Properly stored a partial bottle can be used
Killed Vaccines

† Disadvantages

§ Primer dose needs to be booster in 2-4 weeks

§ Antibodies produced against strains in the vaccine

§ More expensive

§ High levels of antibody for approximately 4-6 months
Antibody Response to Killed Vaccine

- Two KV
- One KV

Titer

Day 0  Day 7  Day 14  Day 21  Day 28  Day 35  Day 42  Day 49  Day 56  Day 63
Pattern Following
Virus Introduction

Acute Disease in Susceptible Animals

Abortions and Early Embryonic Death

PI Animals

Weak or deformed calves
BVDV Biosecurity Resident Herd

- Screen herd for the presence of PI animals
- Institute a sound immunization program
  - MLV vaccines in heifers at 4-6 months and repeat 1 month prior to breeding with MLV
  - MLV boosters during the early post partum period - 30 to 40 days in milk
  - Alternative-Killed virus boosters pre-breeding and repeated each 6 months
BVDV Biosecurity: Acquired Animals

- Adequately immunize new animals 2-4 weeks prior to shipment or assembly.
- Screen acquired animals a virus detection method such as microplate test:
  - Quarantine, isolate new arrivals for 2-4 weeks and, if needed, revaccinate.
- Booster Resident herd 2 to 4 weeks prior to the addition of new animals.
BVDV Biosecurity

✦ Treat animals that are returning from fairs or shows as a biosecurity risk and quarantine.

✦ Avoid nose to nose contact or the use of common waterers (fence line/pastures).
Biosecurity for BVD

Sick animals may be infected and shed virus

- Isolate sick animals from healthy animals
- Move dead animals away from barn for pickup
Biosecurity for BVD

- Young animals (4 - 6 months) are especially susceptible to viral infections.
  - Separate animals with respect to age and group management needs
  - Maintain appropriate animal density to reduce transmission.
  - Maintain proper ventilation and avoid air flow from older animals to younger animals
Biosecurity for BVD

- BVD virus may be transmitted through saliva, urine or feces
  - Keep water troughs, feedbunks and feeding equipment as clean as possible
  - Equipment such as nose leads, pill guns calf feeding equipment, tatooers, gouge dehorners, etc should be kept clean between use and disinfected as appropriate
BVD Websites

Http://www.canr.msu.edu/ans/mdr422.html

Http://www.vetmed.auburn.edu/~brockv/bvdv.html

Http://wislink.org/bvd.htm