

Infectious Diseases of Beef Cattle

Viral Diseases

Viral diseases which cattle are commonly vaccinated against.

- Infectious Bovine Rhinotracheitis (IBR)
- Bovine Virus Diarrhea (BVD)
- Parainfluenza Virus - 3 (PI-3)
- Bovine Respiratory Syncytial Virus (BRSV)

Bacterial Diseases

Bacterial diseases which cattle are commonly vaccinated against.

- *Haemophilus somni* (*Haemophilus somnus*)
- *Mannheimia haemolytica* (*Pasteurella haemolytica*)
- *Pasteurella Multocida*
- *Salmonella*
- Clostridial diseases
- Leptospirosis
- Brucellosis

Other Diseases

- Trichomoniasis
- Vibriosis
- Anaplasmosis
- Coccidiosis
- Neospora
- Atypical Interstitial Pneumonia (etiology?)
- Mycoplasma

Three components necessary to create disease.

- Host
- Environment
- Agent

Bovine Respiratory Disease Complex (BRDC)

- Bovine Respiratory Disease Complex: Shipping Fever (Lay Term)
Disease complex with a multitude of factors and etiologies
 - #1 Cattle health problem
 - Infectious agents
 - ❖ Viruses are the primary pathogens

- ❖ Bacteria, secondary or opportunistic pathogens
- Stress
 - ❖ Transportation
 - ❖ Environment
 - Temperature
 - crowding
 - elevation
 - climate
 - wet, windy
 - dusty
- Immune Status
 - ❖ Herd and individual
- Nutrition
 - ❖ ability to mount an effective immune response
- Biosecurity
 - ❖ Bringing agents onto or into a herd
 - ❖ Foreign animal diseases
 - ❖ Terrorist threats
 - ❖ New and emerging diseases

Viral Diseases

Bovine Herpes virus I

Single serotype with 3 subtypes

- Three subtypes:
 - BHV – 1.1 Respiratory Disease (IBR often see in feedlots)
 - BHV – 1.2 Genital infections
 - BHV – 1.3 Encephalitis
- Suggested to be named BHV - 5 because of genetic differences.

1. (IBR) Infectious Bovine Rhino Tracheitis (BHV-1.1)

- **REDNOSE**
- Highly infectious and contagious
- Etiology Bovine Herpes Virus (BHV-1)
 - DNA VIRUS
 - RESPIRATORY INFECTIONS AND ABORTIONS
 - Primarily a disease of cattle but can also infect deer, goats and pigs.
 - Sources of infection between animals is nasal discharges, (or eye) when effect respiratory system (aerosol spread)

- Other sources for the virus, vaginal or preputial discharges, semen, fetal fluids when disease involves the repro tract.
 - Venereal spread.

- Problem with BHV 1
 - Latent infections, once an animal is infected with herpes virus it is possible the virus may remain in the animal for the rest of its life without showing signs of illness. (enters local nerves and is sheltered from the immune system)
 - The sequestered virus can become reactivated by, stress, corticosteroids or other disease processes,
 - Virus can be shed and may be accompanied with signs of disease. (recrudescence).
 - An example is fed cattle breaking with IBR after being on feed for a period of time.

- Incubation period
 - 3 to 7 days
 - In most beef units will see disease after introduction in 10-20 days.

- Cattle are the natural hosts for this virus.

- Respiratory Disease (most common problem with IBR)
 - Eye and Nasal discharge
 - Nasal inflammation (Rednose)
 - Respiratory Distress
 - Coughing
 - Salivation
 - Elevated temperature (104-106)
 - Decreased milk production
 - Complications from the viral infection
 - Secondary Broncho-Pneumonia
 - Secondary invaders: Mannheimia Haemolytica, Pasteurella Multocida.
 - Mortality ranges from 1 to 10% or more with the respiratory form of ABR.

2. Infectious Pustular vulvovaginitis

■ Reproductive Form

- Usually the respiratory and reproductive forms are not seen together.
- Infectious pustular vulvovaginitis.
 - Infection of the vulva and vagina can last several weeks
 - Clinical sign if often discharge of pus from the vagina
- Infectious bovine penoposthitis
 - Bulls, small amount of purulent discharge from the prepuce
- Endometritis

- Infection of the mucosal surface of the uterus.
- Abortion
 - 6-8 months of pregnancy with the placenta often retained

Diagnosis for IBR

- Virus Isolation (nasal or lung swabs)
- Fluorescent Antibody staining of tissues
- Paired serum samples with a significant rise in titer
- Serum Neutralization tests
 - Indirect haemagglutination test
 - Complement Fixation Test
 - Virus Neutralization
- PCR

Treatment

- If uncomplicated just supportive therapy
 - Real world
 - Will utilize a broad spectrum antibiotic
 - In the face of an outbreak often revaccinate the group with a MLV viral vaccine to stimulate a anamnestic immune response
 - If possible isolate the infected animals
 - Often not possible or practical

IBR Control Considerations

- Vaccination Programs
 - Utilize Modified Live Vaccines
 - intranasal vaccines available for rapid but shorter term immunity
 - Remember immunizing an animal does not protect against latency or reactivation in previously infected animals.
- Following natural infection or vaccination with a MLV vaccine both the humoral and cell mediated immune system is activate.
- Intranasal vaccination
 - Local secretory antibody is produced.
 - Interferon is produced
- Colostral immunity protective for 1-6 months.
- Herd Bio Security Programs
 - isolate new arrivals
 - limit visitors
 - purchase animal from know herds

BVD Bovine Viral Diarrhea

- Caused by a Pestivirus - single stranded RNA virus
 - This virus easily and rapidly mutates.
- Two genotypes
 - Type I and Type II (1000 of strains)

- Many isolates of BVD virus occur and they appear to be somewhat cross reactive.
- Two biotypes of the virus (based on activity in cell culture)
 1. Cytopathic: **cause cell death in tissue culture**
 2. Noncytopathic: **does not cause cell death in tissue culture**
 - The distinction is important to understand the pathogenesis of mucosal disease and persistent infection in beef cattle.
 - Immunologically both biotypes are the same
 - Both occur in type I and type II genotypes
- Both are virulent or can cause disease
- Most frequent route of natural infection is the oral nasal uptake

Definitions

Pathogenesis: The pathologic, physiologic or biochemical mechanism resulting in the development of a disease or morbid process.

Pathologic : 1. Pertaining to pathology. 2. Morbid or diseased, resulting from disease.

Physiologic: Normal as opposed to pathological: denoting the various vital processes.

Pathogenesis of BVD

Clinical conditions

1. None or inapparent disease in a lot of cases
2. Respiratory disease
 - In conjunction with other virus or bacteria
3. Breeding herd reproductive problems
 1. Abortions
 2. Still births
 3. Congenital defects
4. Hemorrhagic syndrome from type II infection
 - Hemorrhages throughout the GI Tract with large amounts of blood clotted in the intestinal lumen.

Horizontal infection

- Post natal (transient or horizontal) infection of a young animal with BVD virus is usually a Subclinical event
 - (usually seen in seronegative animals)
 - 70-90% of the cases are mild and transient
 - mild fever
 - leukopenia
 - develop serum neutralizing antibodies (seroconvert) (IgM, IgG)
- Subclinical disease in the pregnant dam may be a smoldering gun

■ PI (persistently infected)

Infection of a seronegative pregnant cow prior to 120 days of gestation before the immune system of the fetus is developed can result in disease. Virus crosses the placenta, the **foetus is infected** which can then result in 1. Abortion, 2. Mummification, 3. Fetal death, or if it survives until birth can develop a state of 4. Persistent infection.

With Persistent infection

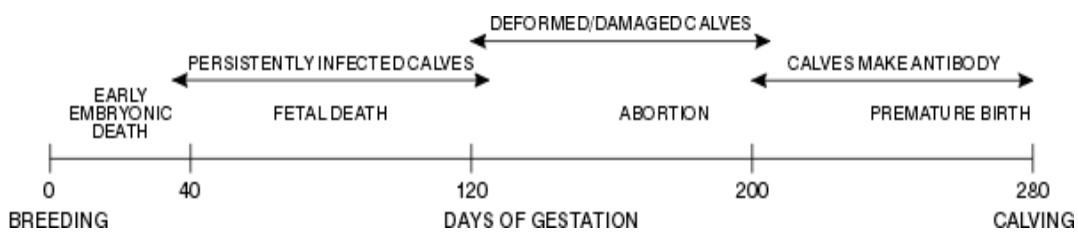
- Fetus survives and develops a state of immune tolerance and the virus persists for the life of the animal.
 - Fetus at birth will be virus positive but seronegative (no titer) to the noncytopathic virus
 - Will shed large # of viral particles via , feces, urine, saliva, mucus
 - Critical source of infection to the rest of the herd
 - Animal born alive considered congenitally infected
 - These animals can have considerable health problems early in life
- Infection past 120 days can still damage the fetus but (calf) is not immunotolerant and viremic. Will have a titer to BVD
 - Cerebellar hypoplasia is often associated with BVD infection of surviving calves

Transmission and Spread

- Transmitted from animal to animal
 - Oral or Nasal
- Virus can survive in fecal matter and other body secretions in the environment for hours to days depending on temperature, humidity, and exposure to sunlight
- BVDV has been experimentally transmitted from PI animals to susceptible animals by fomites such as:
 - nose tongs,
 - injection needles,
 - palpation sleeves
- Most important source of BVD virus is the persistently infected animal
- Other sources for the virus
 - Infected bulls either PI or Post natal infected can shed the virus in their semen PI for life, transient for post natal infected animal for months
 - There has been a case where virus transmission from sheep to cattle sig. not understood at this time
 - BVD has been isolated from a pig
 - Deer have SN titer and can isolate the virus from white blood cells. WBC's

Mucosal Disease (MD)

- Acute and Chronic form of BVD (MUCOSAL DISEASE)
 - Seen in persistently infected animals that are later exposed to a cytopathic virus, the animal breaks with mucosal disease from a few days to month later
 - become super infected with a homologous cytopathic virus
 - Clinical signs are oral erosions, intermittent diarrhea (watery, with fibrin strands, green in color, very fetid), coronary band lesions, weight loss, look unthrifty, rough hair coat, fecal stained hind quarters.
- Animals will not respond to treatment.
- With acute mucosal disease the animal's often die within 3-10 days
- Chronic cases can live for months and slowly debilitate and die.



Diagnostics tests for BVD

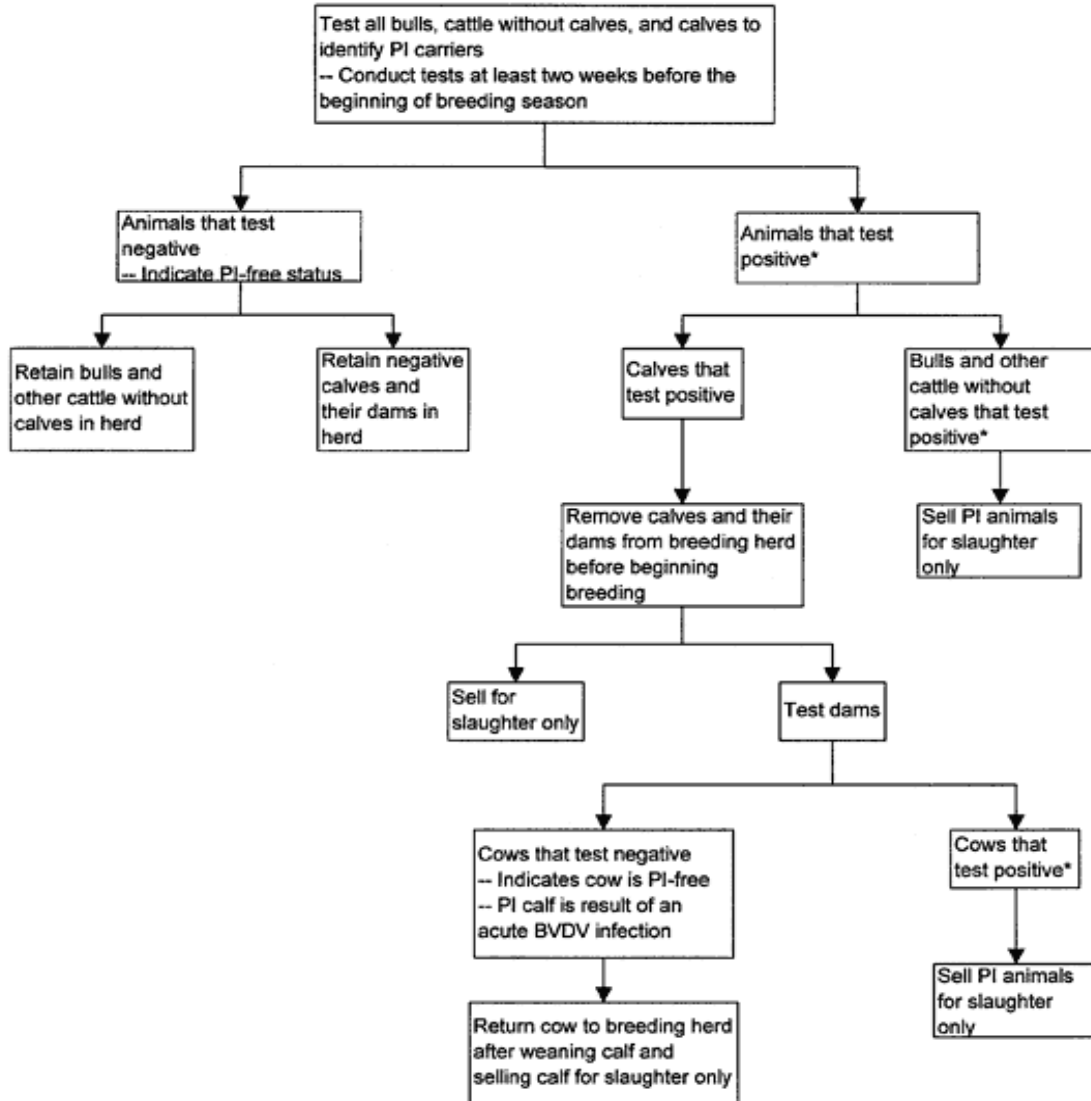
- Virus Isolation (Gold Standard)
- Antigen Capture Elisa rapid and sensitive
- Ear Notch Test Immunohistochemistry (IHC)
 - fixed or frozen tissue.
 - Utilized to differentiate Transient from PI animals (DIFFERENTIATION) NOT 100%
- Polymerase Chain Reaction (PCR)
 - SCREENING USED IN HERD WITH POOLED SAMPLES
 - Differentiate between type 1 and type II virus

Control of BVD within a herd

- Identify persistently infected animals and eliminate them from the herd
 - Usually involves testing the calves first and if a PI calf is identified, test that calf's mother. If she is positive send to slaughter, in negative the cow can return to the herd.
 - All test positives euthanized or slaughter only, do not sell or expose other animals to a PI.
- Prevention of transplacental infection
 - Vaccination program for cow herd and development of protective immune response
- Biosecurity
 - Isolate new additions
 - Buy from a know herd

- Test new additions

Flow chart to identify and eliminate BVD within a cow herd.



Bovine Respiratory Syncytial Virus (BRSV)

- BRSV
 - BRSV is an enveloped single stranded RNA pneumovirus in the paramyxovirus family
- Human respiratory syncytial virus is an important respiratory pathogen in infants and young children.
 - In addition to cattle, sheep and goats can also be infected
- Respiratory disease due to BRSV virus occurs predominantly in young beef and dairy cattle.
- Passive derived immunity does not appear to prevent BRSV infection but will reduce the severity of the disease.
- Can be isolated from the respiratory tract of clinically normal cattle
 - Named for its characteristic cytopathic effect, the formation of syncytial cell
 - BRSSV is associated with the killing of mucosal cells within the lung which results in the formation of giant multinucleated cells (known as syncytia) created by the merging of several cells

Clinical Signs for BRSV

- Can be mild and inapparent
- More severe form
 - increased rectal temperature (104-108°F [40-42°C]),
 - depression
 - increased respiratory rate,
 - cough,
 - nasal and lacrimal discharge.
 - Secondary bacterial pneumonia is a frequent occurrence.
 - Bottle jaw or fluid accumulation in the dewlap and under the jaw
 - Dyspnea (difficult breathing) may become pronounced in the later stages of the disease.
 - Subcutaneous emphysema is sometimes reported.
 - BRSV virus is not associated with reproductive disease in cattle

Diagnosis

- Can be Difficult
 - Paired Serum Samples with a rise in titer.
 - Virus Isolation (can be difficult)
 - Does not survive outside the host well
 - Best source of virus is an animal that is mildly infected.
 - Fluorescent antibody and immunoperoxidase staining

Treatment and Control

- Treatment
 - antimicrobial therapy to control secondary bacterial pneumonia

- Non steroidal anti-inflammatory drugs may provide therapeutic benefit
- Control with vaccination of animals is fair.
 - Will not prevent reinfection of the animal
- Colostrum does not prevent BRSV infection in calves but may modify the severity of the illness
- Source of the virus into the herd is a asymptomatic or carrier animals

Atypical Interstitial Pneumonia (AIP)

- Etiology
 - Unknown
 - Suggestions are
 - Mycoplasma, bacteria P. multocida, toxin - methol indol
 - Often see in feedlot cattle
 - Usually the best doing animals
 - Animal often found dead
 - Clinical signs
 - Interstitial edema and emphysema
 - Rule outs BRSV pneumonia, acute pasteurellosis, allergic response.

Parainfluenza virus PI3

- Enveloped single stranded RNA paramyxovirus
- usually associated with mild to subclinical infections
- The most important role of PI-3 is to serve as an initiator that can lead to the development of secondary bacterial pneumonia.
 - Destroys the cilia of the tracheal mucosa (muco-ciliary apparatus) which then allows bacteria to invade the lung.
- Clinical signs include
 - Pyrexia (a fever or febrile condition)
 - cough,
 - serous nasal and lacrimal discharge
 - increased respiratory rate,
 - Increased breath sounds.
 - The severity of signs worsen with the onset of bacterial pneumonia
 - These signs are associated with respiratory disease from about any cause
- Fatalities from uncomplicated PI-3 pneumonia are rare
- Diagnosis Similar to BRSV
 - Paired serum samples with a rise in titer
 - Virus isolation
 - FA
- Treatment
 - Uncomplicated usually nothing

- But in real life will most likely have the animal on a broad spectrum antibiotic
- Vaccination
 - Usually included with IBR vaccines
 - MLV induce long lived immunity
 - Have Intranasal vaccines Shot term but rapid immunity

Immune response to viral antigens

- BVD protection
 - Fetal infection / Antibodies are protective
 - Respiratory Protection / Cell mediated immunity
- IBR Protection
 - Fetal infection / Antibodies are protective
 - Respiratory - Cell mediated immunity protective
- BRSV
 - Probably cell mediated immunity is protective
 - Colostral immunity not protective but will minimize disease severity
- PI3
 - Humoral protection

Other viruses identified as being involved in BRD

- Bovine herpesvirus-4 has been implicated in several diseases, including BRD.
- Bovine adenovirus has been associated with a wide spectrum of diseases, with bovine adenovirus type 3 being the serotype most often associated with BRD.
- Two serotypes of bovine rhinovirus have been recognized to cause respiratory tract infections in cattle.
- Other viruses associated with BRD include bovine reovirus, enterovirus, and coronavirus.